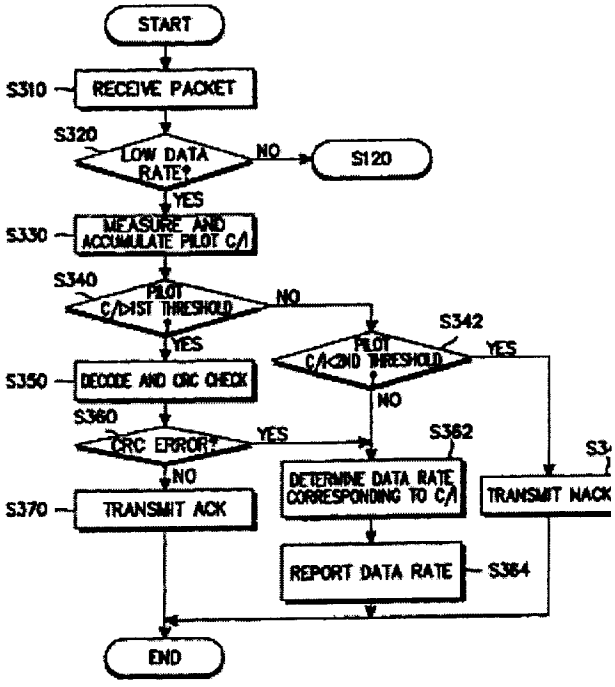
METHOD AND APPARATUS FOR CONTROLLING PACKET TRANSMISSION IN A MOBILE TELECOMMUNICATION SYSTEM

Publication number: JP2004502325T
Publication date: 2004-01-22
Inventor:
Applicant:
Classification:
- international: ***H04L1/00; H04L1/18; H04L1/20; H04L12/56; H04Q7/38;*** **H04L1/00; H04L1/16; H04L1/20; H04L12/56; H04Q7/38;** (IPC1-7): H04Q7/38; H04L1/18
- European: H04L1/00A1; H04L1/00A9A; H04L1/18C; H04L1/18D; H04L1/18R3C; H04L1/18T3A; H04L1/20; H04L12/56B
Application number: JP20020505402T 20010627
Priority number(s): KR20000035793 20000627; WO2001KR01103 20010627

Also published as:
WO0201743 (A1)
US2002018446 (A
KR20020000679 (A
CA2413174 (A1)

Abstract not available for JP2004502325T
Abstract of corresponding document: **WO0201743**

Disclosed is a method of adapting a mobile telecommunication system to channel conditions. To control transmission of a data packet from an access network (AN) in both a link adaptation scheme and an ARQ (Automatic Repeat reQuest) scheme, an access terminal (AT) compares the received power of a forward pilot signal received from the AN with a predetermined first threshold, checks errors in the data packet of a received time slot if the reception power is greater than the first threshold, and transmits a signal requesting termination of retransmission of the data packet to the AN if no errors are found in the data packet after decoding.



(19)日本国特許庁(JP)　(12)公表特許公報(A)　(11)特許出願公表番号
特表2004-502325
(P2004-502325A)
(43)公表日　平成16年1月22日(2004.1.22)

(51)Int.Cl.[7]		F I			テーマコード（参考）
H04Q	7/38	H04B	7/26	109M	5K014
H04L	1/18	H04L	1/18		5K067

審査請求 有　予備審査請求 有　（全 54 頁）

(21)出願番号　特願2002-505402(P2002-505402)
(86)(22)出願日　平成13年6月27日(2001.6.27)
(85)翻訳文提出日　平成14年12月17日(2002.12.17)
(86)国際出願番号　PCT/KR2001/001103
(87)国際公開番号　WO2002/001743
(87)国際公開日　平成14年1月3日(2002.1.3)
(31)優先権主張番号　2000/35793
(32)優先日　平成12年6月27日(2000.6.27)
(33)優先権主張国　韓国(KR)
(81)指定国　EP(AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE,TR),AE,AG,AL,AM,AT,AU,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CR,CU,CZ,DE,DK,DM,DZ,EE,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,MZ,NO,NZ,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

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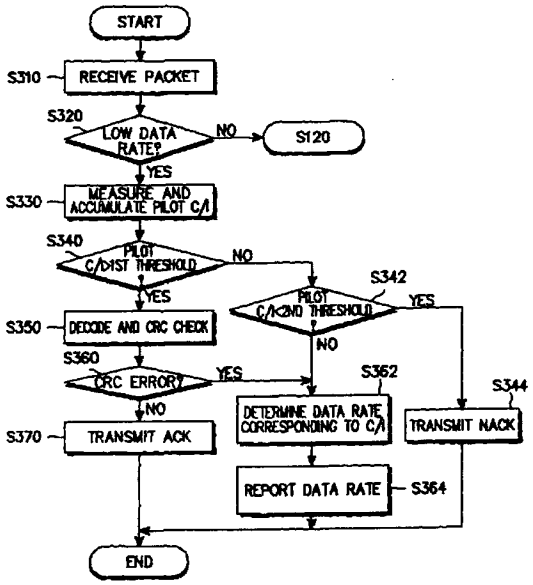
(54)【発明の名称】移動通信システムにおけるパケットの伝送制御方法及び装置

(57)【要約】
本発明は移動通信システムをチャンネルの状態に適応させる方式を開示する。リンク適応方式及びＡＲＱ（Ａｕｔｏｍａｔｉｃ　Ｒｅｐｅａｔ　ｒｅＱｕｅｓｔ）方式で基地局からのデータパケットの伝送を制御するために、端末機は順方向パイロット信号の受信電力値を所定の第１しきい値と比較して前記受信電力値が前記第１しきい値より大きいと、受信したタイムスロット内のデータパケットのエラーを検査する。前記検査の結果、復号化後に前記データパケットにエラーがない場合、前記データパケットの再伝送を終了することを要求する信号を基地局に伝送する。



【特許請求の範囲】
【請求項１】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記端末機が前記基地局によるデータパケットの伝送を制御するための方法において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる過程と、
前記受信電力値が前記第１しきい値より大きいと、受信したタイムスロット内のデータパケットのエラーを検査する過程と、
前記エラー検査の結果、前記データパケットにエラーがない場合、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する過程と
を含むことを特徴とする方法。
【請求項２】
前記受信したデータパケットのプリアンブルの長さを検査して低速データ伝送率であるかを確認する過程と、
前記確認の結果、低速データ伝送率であれば、前記比較過程に進行する過程と
をさらに含み、ここで、
前記低速データ伝送率は、同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項１に記載の方法。
【請求項３】
前記エラー検査の結果、前記データパケットにエラーがある場合、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程と
をさらに含むことを特徴とする請求項１に記載の方法。
【請求項４】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程と
をさらに含むことを特徴とする請求項１に記載の方法。
【請求項５】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる過程と、
前記受信電力値が前記第２しきい値より小さいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する過程と
をさらに含むことを特徴とする請求項１に記載の方法。
【請求項６】
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程とをさらに含むことを特徴とする請求項５に記載の方法。
【請求項７】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値を前記データパケット伝送回数だけ累算した値であることを特徴とする請求項１、請求項４及び請求項５のうち、いずれか一つに記載の方法。
【請求項８】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であるこ

とを特徴とする請求項５または請求項６に記載の方法。
【請求項９】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記端末機が前記基地局によるデータパケットの伝送を制御するための方法において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる過程と、
前記受信電力値が前記第１しきい値より大きいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する過程と
を含むことを特徴とする方法。
【請求項１０】
前記受信したデータパケットのプリアンブルの長さを検査して低速データ伝送率であるかを確認する過程と、
前記確認の結果、低速データ伝送率であれば、前記比較過程に進行する過程と
をさらに含み、ここで、
前記低速データ伝送率は、同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項９に記載の方法。
【請求項１１】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程と
をさらに含むことを特徴とする請求項９に記載の方法。
【請求項１２】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる過程と、
前記受信電力値が前記第２しきい値より小さいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する過程と
をさらに含むことを特徴とする請求項１１に記載の方法。
【請求項１３】
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程と
をさらに含むことを特徴とする請求項１２に記載の方法。
【請求項１４】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項９乃至請求項１３のうち、いずれか一つに記載の方法。
【請求項１５】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、前記現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であることを特徴とする請求項１２または請求項１３に記載の方法。
【請求項１６】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記端末機が前記基地局によるデータパケットの伝送を制御するための方法において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定のしきい値と比べる過

程と、
前記受信電力値が前記しきい値より小さいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する過程と
を含むことを特徴とする方法。
【請求項１７】
前記受信したデータパケットのプリアンブルの長さを検査して低速データ伝送率であるかを確認する過程と、
前記確認の結果、低速データ伝送率であれば、前記比較過程に進行する過程と　をさらに含み、ここで、
前記低速データ伝送率は、同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項１６に記載の方法。
【請求項１８】
前記しきい値は、現在のデータ伝送率に対応する受信電力値にデータパケット伝送回数だけを乗じた値と、所定の余裕間隔との差に、前記データパケットの伝送可能スロットの総数に対するすでに伝送されたスロットの数の比率を乗じた値であることを特徴とする請求項１６に記載の方法。
【請求項１９】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記端末機が前記基地局によるデータパケットの伝送を制御するための方法において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる過程と、
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程と
を含むことを特徴とする方法。
【請求項２０】
前記受信したデータパケットのプリアンブルの長さを検査して低速データ伝送率であるかを確認する過程と、
前記確認の結果、低速データ伝送率であれば、前記比較過程に進行する過程と
をさらに含み、ここで、
前記低速データ伝送率は同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項１９に記載の方法。
【請求項２１】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる過程と、
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記受信電力値に対応するデータ伝送率を決める過程と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する過程と
を含むことを特徴とする請求項１９に記載の方法。
【請求項２２】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項１９乃至請求項２１のうち、いずれか一つに記載の方法。
【請求項２３】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、前記現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であ

ることを特徴とする請求項２１に記載の方法。
【請求項２４】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで前記端末機が前記基地局によるデータパケットの伝送を制御するための方法において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる過程と、
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記基地局に前記データパケットの再伝送を要求する過程と
を含むことを特徴とする方法。
【請求項２５】
前記受信したデータパケットのプリアンブルの長さを検査して低速データ伝送率であるかを確認する過程と、
前記確認の結果、低速データ伝送率であれば、前記比較過程に進行する過程と
をさらに含み、ここで、
前記低速データ伝送率は、同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項２４に記載の方法。
【請求項２６】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる過程と、
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記基地局に前記データパケットの再伝送を要求する過程と
をさらに含むことを特徴とする請求項２４に記載の方法。
【請求項２７】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項２４乃至請求項２６のうち、いずれか一つに記載の方法。
【請求項２８】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、前記現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であることを特徴とする請求項２６に記載の方法。
【請求項２９】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記基地局によるデータパケットの伝送を制御するための装置において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる装置と、
前記受信電力値が前記第１しきい値より大きいと、受信したタイムスロット内のデータパケットを復号化してエラーを検査する装置と、
前記エラー検査の結果、前記データパケットにエラーがない場合、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する装置と　を含むことを特徴とする装置。
【請求項３０】
前記比較装置は、前記受信したタイムスロット内のデータプリアンブルの長さを検査して低速データ伝送率であるかを確認した後、低速データ伝送率であれば、前記比較過程を行うが、ここで、前記低速データ伝送率は同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項２９に記載の装置。
【請求項３１】

前記エラー検査の結果、前記復号化データパケットにエラーがある場合、前記受信電力値に対応するデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装置と
をさらに含むことを特徴とする請求項２９に記載の装置。
【請求項３２】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値に対応するデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装置と
をさらに含むことを特徴とする請求項３１に記載の装置。
【請求項３３】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる装置と、
前記受信電力値が前記第２しきい値より小さいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する装置と
をさらに含むことを特徴とする請求項３１に記載の装置。
【請求項３４】
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記受信電力値に対応するデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装置と
をさらに含むことを特徴とする請求項３３に記載の装置。
【請求項３５】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項２９乃至請求項３４のうち、いずれか一つに記載の装置。
【請求項３６】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、前記現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であることを特徴とする請求項３３または請求項３４に記載の装置。
【請求項３７】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記基地局によるデータパケットの伝送を制御するための装置において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる装置と、
前記受信電力値が前記第１しきい値より大きいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する装置と
を含むことを特徴とする装置。
【請求項３８】
前記比較装置は、前記受信したタイムスロット内のデータプリアンブルの長さを検査して低速データ伝送率であるかを確認した後、低速データ伝送率であれば、前記比較過程を行うが、ここで、前記低速データ伝送率は同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項３７に記載の装置。
【請求項３９】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値に対応するデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装

置と
をさらに含むことを特徴とする請求項３７に記載の装置。
【請求項４０】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる装置と、
前記受信電力値が前記第２しきい値より小さいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する装置と
をさらに含むことを特徴とする請求項３７に記載の装置。
【請求項４１】
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記受信電力値に対応するデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装置と
をさらに含むことを特徴とする請求項４０に記載の装置。
【請求項４２】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項３７乃至請求項４１のうち、いずれか一つに記載の装置。
【請求項４３】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、前記現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であることを特徴とする請求項４０または請求項４１に記載の装置。
【請求項４４】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機を含む移動通信システムで、前記基地局によるデータパケットの伝送を制御するための装置において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定のしきい値と比べる装置と、
前記受信電力値が前記しきい値より小さいと、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する装置と
を含むことを特徴とする装置。
【請求項４５】
前記比較装置は、前記受信したタイムスロット内のデータプリアンブルの長さを検査して低速データ伝送率であるかを確認した後、低速データ伝送率であれば、前記比較過程を行うが、ここで、前記低速データ伝送率は同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項４４に記載の装置。
【請求項４６】
前記しきい値は、現在のデータ伝送率に対応する受信電力値にデータパケット伝送回数だけを乗じた値と所定の余裕間隔との差に、前記データパケットの伝送可能なスロットの総数に対するすでに伝送されたスロットの数の比率を乗じた値であることを特徴とする請求項４４または請求項４５に記載の装置。
【請求項４７】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記基地局によるデータパケットの伝送を制御するための装置において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる装置と、
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値に対応す

るデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装置と
を含むことを特徴とする装置。
【請求項４８】
前記比較装置は、前記受信したタイムスロット内のデータプリアンブルの長さを検査して低速データ伝送率であるかを確認した後、低速データ伝送率であれば、前記比較過程を行うが、ここで、前記低速データ伝送率は同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項４７に記載の装置。
【請求項４９】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる装置と、
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記受信電力値に対応するデータ伝送率を決める装置と、
前記決定データ伝送率を前記基地局へ伝送して前記データパケットの再伝送を要求する装置と
をさらに含むことを特徴とする請求項４７に記載の装置。
【請求項５０】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項４７乃至請求項４９のうち、いずれか一つに記載の装置。
【請求項５１】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して、前記現在のデータパケットに対してすでに伝送された回数を乗じた値であることを特徴とする請求項４９に記載の装置。
【請求項５２】
複数のデータビットをそれぞれ有する連続タイムスロットを通じて伝送しようとするデータパケットを伝送する基地局と、前記基地局から前記データパケットを受信する端末機とを含む移動通信システムで、前記基地局によるデータパケットの伝送を制御するための装置において、
前記基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比べる装置と、
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記決定されたデータ伝送率を基地局に伝送して前記データパケットの再伝送を要求する装置と
を含むことを特徴とする装置。
【請求項５３】
前記比較装置は、前記受信したタイムスロット内のデータプリアンブルの長さを検査して低速データ伝送率であるかを確認した後、低速データ伝送率であれば、前記比較過程を行うが、ここで、前記低速データ伝送率は同一のパケットを２回以上反復伝送するデータ伝送率であることを特徴とする請求項５２に記載の装置。
【請求項５４】
前記受信電力値が前記第１しきい値より小さいか同一であれば、前記受信電力値を所定の第２しきい値と比べる装置と、
前記受信電力値が前記第２しきい値より大きいか同一であれば、前記基地局に前記データパケットの再伝送を要求する装置と
をさらに含むことを特徴とする請求項５２に記載の装置。
【請求項５５】
前記第１しきい値は、前記現在のデータパケットのデータ伝送率に対応する受信電力値をデータパケット伝送回数だけ累算した値であることを特徴とする請求項５２乃至請求項５４のうち、いずれか一つに記載の装置。

【請求項５６】
前記第２しきい値は、現在のデータ伝送率に対応する受信電力値を所定の余裕間隔で除算して前記現在のデータパケットに対してすでに伝送されたスロットの数を乗じた値であることを特徴とする請求項５４記載の方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、移動通信システムにおけるパケット伝送方法及び装置に係り、特に、リンク適応方式及びＡＲＱ（Ａｕｔｏｍａｔｉｃ Ｒｅｐｅａｔ ｒｅＱｕｅｓｔ）方式で順方向チャンネルの状態によって端末機（Ａｃｃｅｓｓ Ｔｅｒｍｉｎａｌ：ＡＴ）が基地局（Ａｃｃｅｓｓ Ｎｅｔｗｏｒｋ：ＡＮ）によるデータパケットの伝送を制御するための方法及び装置に関する。
【０００２】
【従来の技術】
通常、移動通信システムは端末機と基地局から構成される。このような移動通信システムで使用される無線チャンネルでは、距離及び陰影によって伝播経路の減衰量が変化し、システム間の干渉及びフェーディングが深刻であるため、チャンネル状態による受信信号対干渉比（Ｃａｒｒｉｅｒ ｔｏ Ｉｎｔｅｒｆｅｒｅｎｃｅ ｒａｔｉｏ：以下、Ｃ／Ｉと略称する）の変化が大きい。リンク適応方式は受信Ｃ／Ｉなどのチャンネル状態によってデータ伝送率を調節してチャンネルの処理率（Ｔｈｒｏｕｇｈｐｕｔ）を高めるための技術である。このようなリンク適応方式でデータ伝送率は符号化率及び変調方式によって決められるが、すなわち、リンク適応方式を使用するシステムは受信Ｃ／Ｉが大きいときは高い符号化率の符号と高レベルの変調方式を用いてデータ伝送率を高め、受信Ｃ／Ｉが小さいときは低い符号化率の符号と低レベルの変調方式を用いてデータ伝送率を低め、パケットを選択的に反復伝送してチャンネルの信頼度を向上させる。
【０００３】
例えば、３ＧＰＰ２（３ｒｄ Ｇｅｎｅｒａｔｉｏｎ Ｐａｒｔｎｅｒｓｈｉｐ Ｐｒｏｊｅｃｔ ２）で提案されたＨＤＲ（Ｈｉｇｈ Ｄａｔａ Ｒａｔｅ）規格の順方向リンクのリンク適応方式によるＨＤＲの物理階層はＱＰＳＫ（Ｑｕａｄｒａｔｕｒｅ Ｐｈａｓｅ Ｓｈｉｆｔ Ｋｅｙｉｎｇ）、８ＰＳＫ（８－ａｒｙ Ｐｈａｓｅ Ｓｈｉｆｔ Ｋｅｙｉｎｇ）及び１６ＱＡＭ（１６－ａｒｙ Ｑｕａｄｒａｔｕｒｅ Ａｍｐｌｉｔｕｄｅ Ｍｏｄｕｌａｔｉｏｎ）などの３種の変調方式と１／４、３／８及び１／２の３通りの符号化率、さらにパケット反復回数による１３種類の伝送方式によって伝送されることができる。
【０００４】
図１はＨＤＲ順方向及び逆方向リンクを示している。図１を参照すれば、ＨＤＲパケットは一つのスロット当たり２０４８個のチップからなり、半分のスロットに存在するパイロットチャンネルには９６個のチップが割り当てられる。このようなパイロットチャンネルはトラフィックチャンネルと同一の電力で伝送されるので、パイロットチャンネルに対して測定されたＣ／ＩはトラフィックチャンネルのＣ／Ｉと同一である。前記パイロットＣ／Ｉは符号化率及び変調方式を選択する基準となる。
【０００５】
図２は従来技術によるＨＤＲシステムのパケット伝送要求動作を示したフローチャートである。図２を参照すれば、端末機はステップＳ１１０で各スロットを通じてパケットを受信する度にそのパケットのプリアンブル（Ｐｒｅａｍｂｌｅ）を分析して端末機が受信したパケットであるかを確認した後、端末機が受信したパケットであれば、プリアンブルの長さを検査して端末機が要求した伝送速度であるかを確認する。その後、端末機はステップＳ１２０で前記パケットのパイロット信号に対する受信Ｃ／Ｉ値を測定し、ステップＳ１３０で前記受信Ｃ／Ｉ値に対応するデータ伝送率を決める。ステップＳ１４０では前記決定されたデータ伝送率の情報が基地局に帰還伝送される。このとき、前記データ伝送率の情報はＤＲＣ（Ｄａｔａ Ｒａｔｅ Ｃｏｎｔｒｏｌ）と称し、前記ＤＲＣは図１に示し

たように各スロット区間ごとに逆方向リンクのＤＲＣチャンネルを通じて伝送される。

【０００６】

前記決定されたデータ伝送率が低い場合、基地局はチャンネルの信頼度を確保するために一つのパケットを反復的に伝送する。図３はＨＤＲ順方向リンクのデータ伝送率によるパケットの長さを示している。図３を参照すれば、３８．４ｋｂｐｓのデータ伝送率では一つのパケットが１６回、７６．８ｋｂｐｓでは一つのパケットが８回も反復伝送される。しかしながら、６１４．４ｋｂｐｓから２４５７．６ｋｂｐｓまでの高速データ伝送率では一つのパケットが１回だけ伝送される。

【０００７】

ところが、上述したように一つのパケットを反復伝送すると、チャンネルの信頼度は向上するが、一つのパケットが占めるスロット区間は長くなるため、チャンネル予測の誤差が大きく、チャンネルの変化によって符号化率及び変調方式を迅速に対応せず、一つのパケットが資源を長時間占めて無線資源の浪費が発生する。さらに、ＨＤＲ順方向リンクはユーザー間の時分割（Ｔｉｍｅ Ｄｉｖｉｓｉｏｎ Ｍｕｌｔｉｐｌｅｘｉｎｇ：ＴＤＭ）方式を使用するため、ユーザーが低い伝送率で多いタイムスロットを占有する場合、全体的な処理率は悪化するという問題点がある。

【０００８】

一方、ＡＲＱ（Ａｕｔｏｍａｔｉｃ Ｒｅｐｅａｔ ｒｅＱｕｅｓｔ）方式では、端末機が受信したパケットに対するＣＲＣ（Ｃｙｃｌｉｃ Ｒｅｄｕｎｄａｎｃｙ Ｃｈｅｃｋ）を行ってエラーがあるときのみ、基地局にパケット再伝送を要求する。したがって、データ伝送率は実質的に低くなり、チャンネルの信頼度は向上される。さらに、最新式のハイブリッドＡＲＱ方式では、エラー訂正符号を用いてパケット再伝送時の符号化率を低めるか、再伝送された同一順番のパケットを結合して復号化することにより、パケットの信頼度を一層向上させる。

【０００９】

図４は従来技術によるハイブリッドＡＲＱ（ＨＡＲＱ）システムのパケット再伝送要求動作を示したフローチャートである。図４を参照すれば、端末機はステップＳ２１０でパケットを受信し、ステップＳ２２０で前記受信したパケットを以前に受信した同一順番のパケットと結合してパケットシンボルを累算する。前記端末機はステップＳ２３０で前記パケットシンボルを復号化してＣＲＣを行い、ステップＳ２４０ではＣＲＣエラーがあるかを確認する。その結果、ＣＲＣエラーがなければ、前記端末機はステップＳ２５０で基地局にＡＣＫ（Ａｃｋｎｏｗｌｅｄｇｍｅｎｔ）信号を伝送し、復号化データを上位レベルに伝送する。ステップＳ２６０では、前記復号化データが上位レベルで処理され、前記累算シンボルは廃棄される。しかしながら、ＣＲＣエラーがあるときは、ステップＳ２４５で端末機が同一のパケットの再伝送を要求する。

【００１０】

上述しように、ＡＲＱ方式では受信したパケットを復号化した後、ＣＲＣを行う。この場合、チャンネル状態が非常に不良であれば、ＣＲＣ検査過程で続けてエラーを検出し、これにより再伝送を続けて要求するようになる。したがって、反復的な復号化に不必要に多い電力が消耗され、復号化にかかる時間だけ帰還遅延時間も長くなるという問題点が発生する。すなわち、端末機は多数のパケットを貯蔵するのに十分な大容量の記憶装置を必要とする。

【００１１】

チャンネルの状態によって伝送方法及び伝送回数を変更することにより処理率を向上させるための方法としてはリンク適応方式及びＡＲＱ方式がある。しかしながら、リンク適応方式はパケット反復伝送による処理率減少問題、ＡＲＱ方式は電力浪費、遅延時間の増加問題を引き起こして大容量の記憶装置を必要とするという短所がある。

【００１２】

【発明が解決しようとする課題】

従って、本発明の目的は、移動通信システムに使用されるリンク適応方式とＡＲＱ方式で

チャンネル適応速度を速くして処理率を向上させる方法及び装置を提供することにある。
本発明の他の目的は、リンク適応方式及びＡＲＱ方式で復号化を行うか否かを決定した後、パケットのエラーを検査する方法及び装置を提供することにある。
【００１３】
本発明のまた他の目的は、リンク適応方式及びＡＲＱ方式で受信電力値の測定結果によってパケットを再伝送するか否かを決める方法及び装置を提供することにある。
本発明のさらに他の目的は、リンク適応方式及びＡＲＱ方式で受信電力値の測定結果によってパケットを復号化するか否かを決める方法及び装置を提供することにある。
【００１４】
【課題を解決するための手段】
前記本発明の目的はチャネルの状態によって移動通信システムを採用する方式により達成される。リンク適応方式及びＡＲＱ方式で基地局からのデータパケットの伝送を制御するために、端末機は基地局から受信した順方向パイロット信号の受信電力値を所定の第１しきい値と比較して前記受信電力値が前記第１しきい値より大きいと、受信したタイムスロット内のデータパケットにエラーがあるかを検査する。その結果、復号化後、前記データパケットにエラーがない場合、前記データパケットの再伝送を終了することを要求する信号を前記基地局へ伝送する。
【００１５】
【発明の実施の形態】
以下、本発明の好適な実施形態を添付図面を参照して詳細に説明する。下記の説明において、本発明の要旨のみを明瞭にするために関連公知機能または構成に関する具体的な説明は省略する。
【００１６】
以下、本発明で使用する用語を定義する。
ＡＣＫ：受信したパケットにエラーがない場合、パケットの再伝送を中止することを要求する信号
ＮＡＣＫ：受信したパケットを再伝送してもエラーが続けて発生することが確かであれば、パケットの再伝送を中止することを要求する信号
現在のパケット：現在受信しようとする一連の順番を有するパケット
同一のパケット：同一の順番を有するパケット
【００１７】
図５は本発明の実施形態によるＨＤＲシステムのパケット伝送制御動作を示したフローチャートである。図５を参照すれば、ステップＳ３１０で端末機は各タイムスロットを通じてパケットを受信する度に、そのプリアンブルを分析して端末機が受信したパケットであるかを確認する。仮に、端末機が受信したパケットであることが確認されると、端末機はステップＳ３２０でプリアンブルの長さを検査して低速データ伝送率であるかを確認する。ここで、低速データ伝送率とは一つのパケットが少なくとも二回以上伝送される伝送率をいう。パケットの再伝送のない高速データ伝送率の場合、端末機は図２に示した従来の技術のように受信したパケットのパイロットＣ／Ｉ値を測定して（ステップＳ１２０）、前記受信したＣ／Ｉ値に対応するデータ伝送率を決める（ステップＳ１３０）。
【００１８】
しかしながら、低速データ伝送率の場合（パケットの反復伝送時）、端末機はステップＳ３３０で現在受信したパケットの時間区間で順方向のパイロットチャネルまたは順方向のパイロットシンボルに対する受信電力値を測定する。前記現在パケットのパイロットＣ／Ｉ値がすでに測定されていると、すなわち、現在パケットがすでに受信されていると、端末機は前記同一のパケットに対して累算されたパイロットＣ／Ｉ値を計算する。
【００１９】
ステップＳ３４０において、端末機は前記測定されたパイロットＣ／Ｉ値または累算されたパイロットＣ／Ｉ値を所定の第１しきい値と比べる。前記第１しきい値は復号化以後にパケットエラー率を所定の値以下に保障する下限値である。前記第１しきい値は現在のパ

ケットのデータ伝送率に対応するＣ／Ｉ値をパケット伝送回数だけ累算することにより得られる。すなわち、端末機は様々なデータ伝送率に対応する要求Ｃ／Ｉ値を貯蔵するＣ／Ｉテーブルで現在のデータ伝送率に対応するＣ／Ｉ値を検索して前記Ｃ／Ｉ値を用いて第１しきい値を決める。下記の表１にはデータ伝送率に対する要求Ｃ／Ｉ値と第１しきい値の例を示した。

【００２０】

【表１】

データ伝送率	要求Ｃ／Ｉ値	ﾊﾟｹｯﾄ反復回数	第１しきい値
38.4 kbps	-12.0 Db	16	0 dB
76.8 kpbs	-9.0 dB	8	0 dB
102.4 kbps	-7.8 dB	6	0 dB
153.6 kbps	-6.0 dB	4	0 dB
204.8 kbps	-4.8 dB	3	0 dB
307.2 kbps	-3.0 dB	2	0 dB
614.4 kbps	0.0 dB	1	0 dB
921.6 kbps	2.0 dB	1	2 dB
1228.8 kbps	4.0 dB	1	4 dB
1843.2 kbps	7.0 dB	1	7 dB
2457.6 kbps	10.0 dB	1	10 dB

【００２１】

前記パイロットＣ／Ｉ値が前記第１しきい値より大きい場合、ステップＳ３５０で端末機は現在のパケットを復号化してエラー検査を行う。ここで、パケットのエラー検査は各種の方式により行われうるが、本発明ではＣＲＣエラー検査方式を採用する。

前記ＣＲＣ検査の結果、ステップＳ３６０でエラーがない場合、ステップＳ３７０で端末機は基地局へＡＣＫ信号を伝送し、現在のパケットを上位レベルに伝送する。上述したように、ＡＣＫ信号は受信したパケットにエラーのないことを示す。ＡＣＫ信号を受信した基地局は現在のパケットの再伝送を中止し、次のパケットの伝送を開始する。一方、前記ＣＲＣ検査の結果、ステップＳ３６０でエラーがある場合、ステップＳ３６２で端末機は前記パイロットＣ／Ｉ値に対応するデータ伝送率を決め、ステップＳ３６４で基地局へ前記決定されたデータ伝送率情報であるＤＲＣ（Ｄａｔａ Ｒａｔｅ Ｃｏｎｔｒｏｌ）を伝送する。前記ＤＲＣ情報を受信した基地局は端末機が要求するデータ伝送率で現在のパケットを再伝送する。

【００２２】

ステップＳ３４０で前記パイロットＣ／Ｉ値が前記第１しきい値より小さいか同じである場合、端末機はステップＳ３４２で前記パイロットＣ／Ｉ値を所定の第２しきい値と比べる。前記第２しきい値は現在のパケットが全体スロットの数だけ反復伝送されるとしても、パケットエラーが存在することが確かであるパイロットＣ／Ｉ値又は累算パイロットＣ／Ｉ値である。

【００２３】

前記パイロットＣ／Ｉ値が前記第２しきい値より小さい場合、ステップＳ３４４で端末機は復号化を止め、基地局へＮＡＣＫ信号を伝送して現在パケットの再伝送を中止させる。

上述したように、ＮＡＣＫ信号は受信したパケットが正常でないことを示す。この場合、現在のパケットは上位レベルでエラーとして認められる。ＮＡＣＫ信号を受信した基地局は現在パケットの再伝送を中止するか、現在パケットを始めのスロットから再伝送する。前記パイロットＣ／Ｉ値が前記第２しきい値より大きいか同じである場合、ステップＳ３６２で端末機は前記パイロットＣ／Ｉ値に対応するデータ伝送率を決め、ステップＳ３６４で基地局へ前記ＤＲＣ情報を伝送する。前記ＤＲＣ情報を受信した基地局はそのデータ伝送率で現在のパケットを再伝送する。

ここで、前記第２しきい値は下記の式により得られる。

【００２４】

（式１）

第２しきい値＝

（要求Ｃ／Ｉ×現在パケットのスロットの総数÷余裕間隔）

×（現在パケットに対して伝送されたスロットの数／現在パケットに対するスロットの総数）

＝（要求Ｃ／Ｉ÷余裕間隔）×現在パケットに対して伝送されたスロットの数

または、

（式２）

第２しきい値［ｄＢ］＝

要求Ｃ／Ｉ［ｄＢ］－余裕間隔［ｄＢ］

＋１０×ｌｏｇ$_{10}$（現在パケットに対して伝送されたスロットの数）

【００２５】

すなわち、第２しきい値は現在のデータ伝送率に対応するＣ／Ｉ値を所定の余裕間隔で除算して前記現在のパケットに対してすでに伝送されたスロットの数を乗ずることにより得られる。前記第２しきい値は伝送されたスロットの数によって変化する。前記余裕間隔は第２しきい値に対する信頼度によって決められる。すなわち、ＮＡＣＫに対する信頼度を高くするときは余裕間隔を増加させ、ＮＡＣＫに対する信頼度を低くするときは余裕間隔も縮小させる。

【００２６】

以下、データ伝送率７６．８ｋｂｐｓで５スロットが伝送された場合、第２しきい値を決める例について説明する。要求Ｃ／Ｉ値は表１でのように－９．０ｄＢとし、余裕間隔は３．０ｄＢとする。すでに伝送されたスロットの数は１０＊ｌｏｇ（５）＝７．０ｄＢである。前記第２しきい値は－９．０ｄＢ－３．０ｄＢ＋７．０ｄＢ＝－５．０ｄＢとなる。表２には７６．８ｋｂｐｓの伝送率で伝送されたスロットの数に対する第２しきい値の例を示した。

【００２７】

【表２】

伝送されたスロットの数	第２しきい値
1	-12.0 dB
2	-9.0 dB
3	-7.2 dB
4	-6.0 dB
5	-5.0 dB
6	-4.2 dB
7	-3.6 dB
8	-3.0 dB

【００２８】
上述したように、端末機は受信パイロットＣ／Ｉ値の比較結果及びＣＲＣエラーの検査結果によってＤＲＣ、ＡＣＫ及びＮＡＣＫのうち、いずれか一つをＤＲＣチャンネルを通じて伝送する。
表３には、本発明の実施形態によってＤＲＣチャンネルを通じて伝送される情報の例を示した。
【００２９】
【表３】

ＤＲＣシンボル	意味
0000	38.4 kbps
0001	76.8 kbps
0010	102.4 kbps
0011	153.6 kbps (short)
0100	153.6 kbps (long)
0101	204.8 kbps
0110	307.2 kbps (short)
0111	307.2 kbps (long)
1000	614.4 kbps
1001	921.6 kbps
1010	1228.8 kbps
1011	1843.2 kbps
1100	2457.6 kbps
1101	ACK
1110	not used
1111	NACK

【００３０】
表３を参照すれば、４ビットのＤＲＣシンボルの００００乃至１１００は各々のデータ伝送率を示すが、１１０１はＡＣＫを、１１１１はＮＡＣＫを示す。表３において、ｓｈｏｒｔは短いパケットを、ｌｏｎｇは長いパケットを示す。
図６は本発明の実施形態によるＨＤＲシステムの順方向及び逆方向リンクのスロット送受信関係を示した図である。図６において、基地局が順方向リンク（ＡＮ Ｔｘ）のスロットを通じてパケットを反復伝送すると、端末機は各スロットを受信する度にＤＲＣ、ＡＣＫ及びＮＡＣＫのうち、いずれか一つを逆方向のＤＲＣチャンネル（ＡＴ Ｔｘ）を通じて帰還させる。
【００３１】
図７は本発明の実施形態によるＨＤＲ端末機の送信機構造を示している。図７を参照すれば、端末機のＣ／Ｉ測定器１１０が基地局から受信したパイロットチャンネルまたはパイロットシンボルに対してＣ／Ｉ値を測定する。Ｃ／Ｉ累算器１２０は同一のパケットがすでに受信されているかを確認して同一のパケットが存在すると、前記パケットのパイロットＣ／Ｉ値を累算する。Ｃ／Ｉ比較器１３０は前記累算されたパイロットＣ／Ｉ値を所定の第１しきい値及び第２しきい値とそれぞれ比べてその比較結果をＤＲＣ制御器１７０へ伝送する。ＤＲＣ制御器１７０は前記測定されたパイロットＣ／Ｉ値に対応するデータ伝送率を決め、ＤＲＣシンボルを生成する。
【００３２】

トラフィックシンボル累算器１４０は前記同一のパケットのトラフィックシンボルを累算し、復号化器１５０は前記累算されたパイロットＣ／Ｉ値が第１しきい値より大きい場合のみ、前記累算されたトラフィックシンボルを復号化する。ＣＲＣ検査器１６０は前記復号化されたトラフィックシンボルのＣＲＣ検査を行い、その結果をＤＲＣ制御器１７０へ伝送する。

【００３３】

ＤＲＣ制御器１７０は前記Ｃ／Ｉ比較結果及びＣＲＣ検査結果に基づいてメモリ１８０に貯蔵されたＡＣＫ、ＮＡＣＫ及びＤＲＣシンボルのうち、いずれか一つを選択して逆方向リンクのＤＲＣチャンネルを通じて伝送する。前記メモリ１８０には表１に示したＤＲＣチャンネルを通じて伝送される情報が貯蔵される。

【００３４】

上述した本発明の実施形態は変形が可能である。例えば、受信電力値（すなわち、受信Ｃ／Ｉ値）の測定正確度が一定の範囲内で維持されると、ＡＣＫ信号はＣＲＣ検査なしに直接伝送が可能である。すなわち、端末機はステップＳ３４０で順方向パイロット信号に対して測定された受信電力値を第１しきい値と比べて前記受信電力値が前記第１しきい値より大きいと、ステップＳ３７０に進行して基地局に直接ＡＣＫ信号を伝送する。

【００３５】

他の例では、前記受信Ｃ／Ｉ値がステップＳ３４０で第１しきい値より小さいか同じであれば、ステップＳ３６２及びステップＳ３６４に進行して基地局にパケットの再伝送を要求することができる。

さらに他の例では、端末機が受信電力値を第１しきい値と比べるまえにステップＳ３４２で第２しきい値と比べて前記受信電力値が前記第２しきい値より小さいと、ステップＳ３４４に進行してＮＡＣＫ信号を基地局に直接伝送することもできる。

【００３６】

図８は本発明の他の実施形態によるハイブリッドＡＲＱシステムのパケット再伝送要求動作を示したフローチャートである。図８を参照すれば、ステップＳ４１０で基地局から端末機へパケットが受信されると、端末機は前記パケットが伝送される時間区間（以下、現在パケット区間という）に該当するパイロットチャンネルのＣ／Ｉ値を測定する。前記同一パケットに対して測定されたパイロットＣ／Ｉ値がすでに存在すると、ステップＳ４２０で前記端末機は前記すでに存在するパイロットＣ／Ｉ値に現在パケットのパイロットＣ／Ｉ値を累算する。さらに、ステップＳ４３０で前記同一のパケットがすでに受信されていると、前記端末機は前記同一のパケットのトラフィックシンボルを累算する。仮に、ハイブリッドＡＲＱでない場合、ステップＳ４３０でトラフィックシンボルは累算されない。

【００３７】

端末機はステップＳ４４０で前記測定されたパイロットＣ／Ｉ値または累算されたパイロットＣ／Ｉ値を所定の第１しきい値と比較する。前記第１しきい値は現在パケットのデータ伝送率に対応するＣ／Ｉ値をパケットの反復回数だけ累算した値である。前記パイロットＣ／Ｉ値が前記第１しきい値より大きい場合、端末機はステップＳ４５０で前記累算されたトラフィックシンボルを復号化してＣＲＣ検査を行う。

【００３８】

前記ＣＲＣ検査の結果、ステップＳ４６０でエラーがない場合、ステップＳ４７０で端末機は基地局にＡＣＫ信号を帰還伝送して現在パケットの再伝送を中止させる。ステップＳ４８０で端末機は現在のパケットを上位レベルに伝送し、前記復号化データ及び前記パイロットＣ／Ｉ値は廃棄する。さらに、前記ＣＲＣ検査の結果、ステップＳ４６０でエラーがある場合、ステップＳ４６２で端末機は基地局に現在パケットの再伝送を要求する信号を伝送する。

【００３９】

一方、前記パイロットＣ／Ｉ値が前記第１しきい値より小さいか同一である場合、端末機はステップＳ４２２で前記パイロットＣ／Ｉ値を所定の第２しきい値と比べる。前記第２

しきい値は前記現在のパケットが前記パケットの最大伝送回数だけ伝送されるとしても、パケットエラーが発生することが確かである値を示す。前記第２しきい値はパケットの伝送回数によって変化する。ＡＲＱシステムにおいて、前記第２しきい値は、式１に示したように、現在のデータ伝送率に対応するＣ／Ｉ値を所定の余裕間隔で除算して、現在パケットの伝送回数を乗ずることにより得られる。

【００４０】

前記パイロットＣ／Ｉ値が前記第２しきい値より小さいと、ステップＳ４４６で端末機は基地局へＮＡＣＫ信号を伝送する。ＮＡＣＫ信号を受信した基地局は、前記パケットを始めのスロットから伝送するか、前記パケットの再伝送を放棄して前記パケットに割り当てられた資源を他のユーザーに割り当てる。一方、前記パイロットＣ／Ｉ値が前記第２しきい値より大きいか同一であれば、ステップＳ４６２で端末機は前記パケットの再伝送を要求する信号を基地局へ伝送する。

【００４１】

上述したように、本発明の第２実施形態においては、受信パイロットＣ／Ｉ値が第１しきい値より大きく、ＣＲＣエラーがある場合及び受信パイロットＣ／Ｉ値が第１しきい値より小さいか同一であり、第２しきい値よりは大きい場合、端末機は再伝送を要求する信号を基地局へ伝送する。

【００４２】

本発明の第１実施形態と同様に、本発明の第２実施形態も変形が可能である。受信Ｃ／Ｉ値の測定正確度が一定の範囲内で維持されると、ＡＣＫ信号はＣＲＣ検査なしに直接伝送が可能である。すなわち、端末機はステップＳ４４０で順方向パイロット信号に対して測定された受信Ｃ／Ｉ値を第１しきい値と比べて前記受信Ｃ／Ｉ値が前記第１しきい値より大きいと、ステップＳ４７０に進行して基地局に直接ＡＣＫ信号を伝送する。

【００４３】

他の例では、前記受信Ｃ／Ｉ値がステップＳ４４０で第１しきい値より小さいか同じであれば、ステップＳ４６２に進行して基地局にパケットの再伝送を要求する。

さらに他の例では、端末機が受信Ｃ／Ｉ値を第１しきい値と比べるまえにステップＳ４４２で第２しきい値と比べて前記受信Ｃ／Ｉ値が前記第２しきい値より小さいと、ステップＳ４４６に進行してＮＡＣＫ信号を基地局に直接伝送することができる。

【００４４】

【発明の効果】

上述したように、本発明は次のような利点を有する。第一に、リンク適応方式及びＡＲＱ方式の移動通信システムで受信電力の測定結果によって復号化及びＣＲＣ検査を行うことにより、不必要な復号化及びＣＲＣ検査過程を除去する。したがって、チャンネルの処理率を高めて復号化に必要な電力消費を減少させるのみならず、帰還時間の減少による送信機記憶装置の要求量も減少させることができる。第二に、受信電力の測定結果によって受信リンクの状態を予測してＡＣＫ又はＮＡＣＫ信号を基地局へ伝送することにより、基地局の不必要なパケット再伝送を防止することができる。

【００４５】

一方、本発明の詳細な説明では具体的な実施形態について説明したが、本発明の特許請求の範囲を逸脱しない限り、各種の変形が該当技術分野における通常の知識をもつ者により可能なのは明らかである。

【図面の簡単な説明】

【図１】ＨＤＲ順方向及び逆方向リンクを示した図である。

【図２】従来技術によるＨＤＲシステムのパケット再伝送要求動作を示したフローチャートである。

【図３】ＨＤＲ順方向データ伝送率によるパケットの伝送を示した図である。

【図４】従来技術によるハイブリッドＡＲＱシステムのパケット再伝送要求動作を示したフローチャートである。

【図５】本発明の実施形態によるＨＤＲシステムのパケット伝送制御動作を示したフロー

チャートである。
【図６】本発明の実施形態によるＨＤＲシステムの順方向及び逆方向リンクを示した図である。
【図７】本発明の実施形態によるＨＤＲシステム端末機の送信機構造を示した図である。
【図８】本発明の他の実施形態によるハイブリッドＡＲＱシステムのパケット伝送制御動作を示したフローチャートである。
【符号の説明】
１１０…Ｃ／Ｉ測定器
１２０…Ｃ／Ｉ累算器
１３０…Ｃ／Ｉ比較器
１４０…トラフィックシンボル累算器
１５０…復号化器
１６０…ＣＲＣ検査器
１７０…ＤＲＣ制御器
１８０…メモリ

【国際公開パンフレット】

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 January 2002 (03.01.2002)

PCT

(10) International Publication Number
WO 02/01743 A1

(51) International Patent Classification⁷: H04B 1/69

(21) International Application Number: PCT/KR01/01103

(22) International Filing Date: 27 June 2001 (27.06.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2000/35793 27 June 2000 (27.06.2000) KR

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(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

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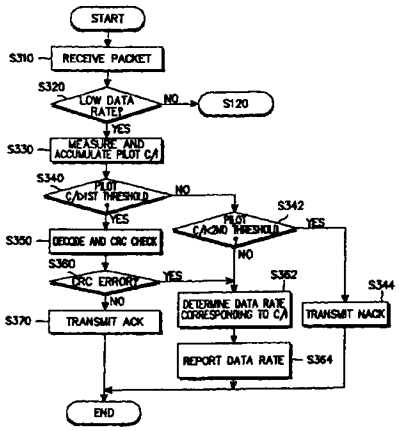
(54) Title: METHOD AND APPARATUS FOR CONTROLLING PACKET TRANSMISSION IN A MOBILE TELECOMMUNICATION SYSTEM



(57) Abstract: Disclosed is a method of adapting a mobile telecommunication system to channel conditions. To control transmission of a data packet from an access network (AN) in both a link adaptation scheme and an ARQ (Automatic Repeat reQuest) scheme, an access terminal (AT) compares the received power of a forward pilot signal received from the AN with a predetermined first threshold, checks errors in the data packet of a received time slot if the reception power is greater than the first threshold, and transmits a signal requesting termination of retransmission of the data packet to the AN if no errors are found in the data packet after decoding.

WO 02/01743 A1

WO 02/01743 A1

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*
— *entirely in electronic form (except for this front page) and available upon request from the International Bureau*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

METHOD AND APPARATUS FOR CONTROLLING PACKET TRANSMISSION IN A MOBILE TELECOMMUNICATION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a method and apparatus for transmitting packets in a mobile telecommunication system, and in particular, to a method and apparatus for controlling transmission of data packets from an AN (Access Network) according to forward channel conditions by an AT (Access Terminal) in both a link adaptation scheme and an ARQ (Automatic Repeat reQuest) scheme.

2. Description of the Related Art

Mobile telecommunication systems typically include ATs and ANs. As a result of attenuation variations along a propagation path, severe inter-system interference, and fading according to a path distance and shadowing, the carrier-to-interference ratio (C/I) of a radio channel may significantly change depending on channel conditions. Link adaptation is a scheme of adapting a data rate to channel conditions such as received C/I in order to increase channel throughput. In the link adaptation scheme, the data rate is determined according to a code rate and a modulation. A link adaptation system increases a data rate by means of high code rate codes and high-level modulation when a received C/I is high. If the received C/I is low, the link adaptation system decreases the data rate by means of low code rate codes and low level modulation and retransmits packets selectively to thereby increase channel reliability.

In an HDR (High Data Rate) system standardized by the 3GPP2 (3rd Generation Partnership Project 2), physical layers using link adaptation on the forward link can be transmitted in 13 ways according to three modulation schemes, QPSK (Quadrature Phase Shift Keying), 8PSK (8-ary Phase Shift Keying), and 16QAM (16-ary Quadrature Amplitude Modulation), three code rates, 1/4, 3/8 and 1/2, and the number of slots in which a packet is repeatedly transmitted.

FIG. 1 illustrates HDR forward and reverse links. Referring to FIG. 1, an

HDR packet includes 2048 chips per slot and a pilot channel in each half slot is assigned to 96 chips. Since the pilot channel is transmitted with the same power as that of a traffic channel, the C/I of the pilot channel is equal to that of the traffic channel. The pilot C/I becomes a criterion by which a code rate and modulation are determined.

FIG. 2 is a flowchart illustrating a packet transmission requesting procedure in a conventional HDR system. Referring to FIG. 2, upon receipt of a packet in each slot, an AT analyzes the preamble of the packet, checks whether the packet is destined for the AT, and if it is, checks whether an AN transmitted the packet at a data rate requested by the AT by detecting the length of the preamble in step S110. The AT measures the received C/I of a pilot signal in the packet in step S120 and determines a data rate corresponding to the received C/I in step S130. The AT feeds back information about the determined data rate in step S140. Here, the data rate information is called DRC (Data Rate Control) information, which is transmitted in each slot on a reverse DRC channel as shown in FIG. 1.

If the determined data rate is low, the AN transmits the packet repeatedly to ensure channel reliability. FIG. 3 illustrates packet lengths versus data rates on the HDR forward link. Referring to FIG. 3, the same packet is transmitted 16 times at 38.4kbps and 8 times at 76.8kbps. The packet is transmitted once at a high data rate of from 614.4 through 2457.6kbps.

Despite the advantage of increased channel reliability, the repeated transmission of one packet results in the increase of channel estimation errors, slow adaptation of a code rate and modulation to channel changes, and dissipation of radio resources because one packet occupies a long slot period. In addition, since the HDR forward link is subject to TDM (Time Division Multiplexing) between users, if the users occupy many time slots at low data rates, the overall throughput is reduced.

On the other hand, in the case of ARQ, the AT performs a CRC (Cyclic Redundancy Code) check on a received packet and requests packet retransmission to the AN only if the packet has errors. Therefore, a data rate is virtually decreased and channel reliability is increased. In an advanced hybrid ARQ scheme, packet reliability is further increased by reducing a code rate in packet retransmission using error correction codes or by decoding packets of the same

sequence number in combination.

FIG. 4 is a flowchart illustrating a packet retransmission requesting procedure in a conventional hybrid ARQ (HARQ) system. Referring to FIG. 4, an AT receives a packet in step S210 and accumulates packet symbols by combining the received packet with previously received packets of the same sequence number in step S220. The AT decodes the packet symbols and performs a CRC check in step S230 and determines whether CRC errors exist in step S240. If no CRC errors are found, the AT transmits an ACK (Acknowledgment) signal to an AN and the decoded data to an upper layer in step S250. The decoded data is processed in the upper layer and the accumulated symbols are discarded in step S260. On the other hand, if CRC errors are found, the AT requests retransmission of the same packet to the AN in step S245.

As described above, the CRC check is performed after decoding a received packet in ARQ. If a channel condition is very bad, errors will be detected continuously in the CRC check and retransmission will be requested continuously. Therefore, much power is dissipated for repeated decoding and a feedback delay is prolonged as much time as required for the decoding. This implies that the AT needs a memory of capacity large enough to store many packets.

Link adaptation and ARQ increase channel throughput by adapting a transmission scheme and the number of transmission times to channel conditions. Yet, the former may decrease the throughput by repeated packet transmission, whereas the latter has the problems of power dissipation, increased delay time, and the requirement of a large capacity memory.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a method and apparatus for increasing a channel adaptation speed and as a result, increasing throughput in both a link adaptation and an ARQ mobile telecommunication system.

Another object of the present invention is to provide a method and apparatus for checking packet errors after determining whether decoding should be performed or not in link adaptation and ARQ.

A further object of the present invention is to provide a method and apparatus for determining whether a packet is to be retransmitted according to a received C/I measurement in link adaptation and ARQ.

Still another object of the present invention is to provide a method and apparatus for determining whether a packet is to be decoded according to a received C/I measurement in link adaptation and ARQ.

The foregoing and other objects of the present invention can be achieved by a method of adapting a mobile telecommunication system to channel conditions. To control transmission of a data packet from an AN in both a link adaptation scheme and an ARQ scheme, an access terminal (AT) compares the received C/I of a forward pilot signal received from the AN with a predetermined first threshold, checks errors in the data packet of a received time slot if the received C/I is greater than the first threshold, and transmits a signal requesting termination of retransmission of the data packet to the AN if no errors are found in the data packet after decoding.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates HDR forward and reverse links;

FIG. 2 is a flowchart illustrating a packet retransmission requesting procedure in a conventional HDR system;

FIG. 3 illustrates packet transmission according to HDR forward data rates;

FIG. 4 is a flowchart illustrating a packet retransmission requesting procedure in a conventional hybrid ARQ system;

FIG. 5 is a flowchart illustrating a packet transmission control operation in high data rate system according to an embodiment of the present invention;

FIG. 6 illustrates high data rate system forward and reverse links according to the embodiment of the present invention;

FIG. 7 is a block diagram of a transmitter in high data rate system AT according to the embodiment of the present invention; and

FIG. 8 is a flowchart illustrating a packet transmission control operation

in a hybrid ARQ system according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

Terms used herein will first be defined.

ACK: a signal requesting discontinuation of retransmission of a packet if a received packet has no errors;

NACK: a signal requesting discontinuation of retransmission of a packet if errors are sure to be generated in the packet even if it is retransmitted;

Current packet: a packet with a sequence number to be received at the present time; and

Identical packets: packets with the same sequence number.

FIG. 5 is a flowchart illustrating a packet transmission control operation in an HDR system according to an embodiment of the present invention. Referring to FIG. 5, upon receipt of a packet in each slot, an AT analyses the preamble of the packet, checks whether the packet is destined for the AT in step S310. If it is, the AT determines the length of the preamble and checks whether the data rate of the packet is a low data rate in step S320. Here, a low data rate is defined as a data rate at which the same packet is transmitted at least twice. In the case of a high data rate without packet retransmission, the AT measures the pilot C/I of the received packet in step S120 and determines a data rate corresponding to the received C/I in step S130 in the conventional procedure of FIG. 2.

In the case of a low data rate (repeated packet transmission), the AT measures the received C/I of a forward pilot channel or a forward pilot symbol in the time period of the current packet in step S330.. If the pilot C/I of the current packet has already been measured, in other words, if the current packet was received previously, the AT calculates the accumulated pilot C/I of the same packets.

In step S340, the AT compares the measured pilot C/I or the accumulated pilot C/I with a predetermined first threshold. The first threshold is the lowest value that ensures a packet error rate below a predetermined value after packet decoding. The first threshold can be calculated by accumulating a C/I corresponding to the data rate of the current packet as many times as the maximum number of packet transmissions. The AT searches for a C/I corresponding to the current data rate in a C/I table listing C/I requirements versus data rates and determines the first threshold utilizing the C/I. Table 1 shown below illustrates C/I values required for data rates, and the resulting first thresholds.

(Table 1)

Data rate	Required C/I	Packet repetition	First threshold
38.4 kbps	-12.0 dB	16	0 dB
76.8 kbps	-9.0 dB	8	0 dB
102.4 kbps	-7.8 dB	6	0 dB
153.6 kbps	-6.0 dB	4	0 dB
204.8 kbps	-4.8 dB	3	0 dB
307.2 kbps	-3.0 dB	2	0 dB
614.4 kbps	0.0 dB	1	0 dB
921.6 kbps	2.0 dB	1	2 dB
1228.8 kbps	4.0 dB	1	4 dB
1843.2 kbps	7.0 dB	1	7 dB
2457.6 kbps	10.0 dB	1	10 dB

If the pilot C/I is greater than the first threshold, the AT decodes the current packet and performs an error check in step S350. The error check can be performed in many ways. In the present invention, a CRC error checks is performed.

If no errors are found in the CRC check in step S360, the AT transmits an ACK signal to the AN and the packet to an upper layer in step S370. As stated before, the ACK signal indicates that the received packet has no errors. Upon receipt of the ACK signal, the AN discontinues retransmission of the packet and initiates transmission of the next packet. On the other hand, if errors are found in the CRC check in step S360, the AT determines a data rate corresponding to the pilot C/I in step S362 and transmits DRC(Data Rate Control) information

indicating the determined data rate to the AN in step S364. Upon receipt of the DRC information, the AN retransmits the packet at the requested data rate.

If the pilot C/I is equal to or less than the first threshold in step S340, the AT compares the pilot C/I with a predetermined second threshold in step S342. The second threshold is a pilot C/I or an accumulated pilot C/I with which packet errors are sure to exist even if the current packet is repeatedly transmitted a total slot number of times.

If the pilot C/I is less than the second threshold, the AT quits decoding and transmits a NACK signal to the AN to discontinue the retransmission of the current packet in step S344. As stated before, the NACK signal indicates that the received packet is abnormal. In this case, the upper layer considers the current packet as an error. Upon receipt of the NACK signal, the AN discontinues the retransmission of the packet, or retransmits the packet from the beginning slot. If the pilot C/I is greater than or equal to the second threshold, the AT determines the data rate corresponding to the pilot C/I in step S362 and transmits the DRC information to the AN in step S364. Upon receipt of the DRC information, the AN retransmits the packet at the requested data rate.

The second threshold is calculated by

$$\text{second threshold} = (\text{required C/I} \times \text{total number of slots for current packet} + \text{margin}) \times \frac{\text{number of slots transmitted for current packet}}{\text{total number of slots for current packet}}$$
$$= (\text{required C/I} + \text{margin}) \times \text{number of slots transmitted for current packet} \quad \ldots\ldots(1)$$

or

$$\text{second threshold [dB]} = \text{required C/I[dB]} - \text{margin[dB]} + 10 \times \log_{10}(\text{number of slots transmitted for current packet}) \quad \ldots\ldots(2)$$

The second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current packet. The second threshold varies with the number of transmitted slots. The margin is determined according to the reliability of the second threshold. If the reliability of NACK is to be high, the margin increases and if the reliability of NACK is to be low, the

margin drops.

Now there will be given a description of a second threshold when five slots were transmitted at 76.8kbps. A required C/I is -9.0dB according to Table 1 and a margin is given as 3.0dB. The number of slots already transmitted is 10*log(5) ≈ 7.0 in dB scale. Then, the second threshold is -9.0dB - 3.0dB + 7.0 dB = -5.0dB. Table 2 lists second thresholds versus transmitted slot numbers at 76.8kbps.

(Table 2)

Number of transmitted slots	Second threshold
1	-12.0 dB
2	-9.0 dB
3	-7.2 dB
4	-6.0 dB
5	-5.0 dB
6	-4.2 dB
7	-3.6 dB
8	-3.0 dB

As described above, the AT transmits one of DRC, ACK, and NACK to the AN on the DRC channel according to the pilot C/I comparison result and the CRC check result.

Table 3 illustrates information examples transmitted on the DRC channel according to the embodiment of the present invention.

(Table 3)

DRC symbol	Information
0000	38.4 kbps
0001	76.8 kbps
0010	102.4 kbps
0011	153.6 kbps (short)
0100	153.6 kbps (long)
0101	204.8 kbps
0110	307.2 kbps (short)
0111	307.2 kbps (long)

1000	614.4 kbps
1001	921.6 kbps
1010	1228.8 kbps
1011	1843.2 kbps
1100	2457.6 kbps
1101	ACK
1110	not used
1111	NACK

Referring to Table 3, values 0000 to 1100 of the 4-bit DRC symbol indicate data rates, 1101 indicates ACK, and 1111 indicates NACK. Short and long in Table 3 indicate a short packet and a long packet, respectively.

FIG. 6 illustrates the relationship in slot transmission/reception between the forward link and the reverse link in the HDR system according to the embodiment of the present invention. In FIG. 6, the AN repeatedly transmits a packet in slots on the forward link (AN Tx). Upon receipt of each slot, the AT feeds back one of DRC, ACK, and NACK on the reverse DRC channel (AT Tx).

FIG. 7 is a block diagram of a transmitter in an HDR AT according to the embodiment of the present invention. Referring to FIG. 7, a C/I measurer 110 measures the C/I of a pilot channel or a pilot symbol received from an AN. A C/I accumulator 120 determines whether the same packet was received previously and accumulates the pilot C/I values of the packets if the same packet exists. A C/I comparator 130 compares the accumulated pilot C/I with a first threshold and a second threshold, respectively and transmits the comparison results to a DRC controller 170. The DRC controller 170 determines a data rate corresponding to the measured pilot C/I and generates a DRC symbol representative of the data rate.

A traffic symbol accumulator 140 accumulates the traffic symbols of the same packets and a decoder 150 decodes the accumulated traffic symbols only if the accumulated pilot C/I is greater than the first threshold. A CRC checker 160 performs a CRC check on the decoded traffic symbols and transmits the check result to the DRC controller 170.

The DRC controller 170 selects one of ACK, NACK, and a DRC symbol from a memory 180 based on the C/I comparison results and CRC check result and transmits the selected signal on a reverse DRC channel. The memory 180

stores information shown in Table 1 to be transmitted on the DRC channel.

Modifications can be made to the above embodiment of the present invention. For example, if the accuracy of received C/I measurement (i.e., received C/I measurement) is maintained within a predetermined range, the ACK signal can be transmitted directly without the CRC check. That is, the AT compares the received C/I of a forward pilot signal with the first threshold in step S340 and if the received C/I is greater than the first threshold, it transmits the ACK signal directly to the AN in step S370, as shown in FIG. 5.

It can be further contemplated that if the received C/I is equal to or less than the first threshold in step S340, it jumps to steps S362 and S364 and requests packet retransmission to the AN.

The AT can compare the received C/I with the second threshold in step S342 before comparing it with the first threshold and if the received C/I is less than the second threshold, the AT can transmit the NACK signal directly to the AN in step S344.

FIG. 8 is a flowchart illustrating a packet retransmission requesting procedure in a hybrid ARQ system according to another embodiment of the present invention. Referring to FIG. 8, upon receipt of a packet from an AN in step S410, an AT measures the C/I of a pilot channel in the time period when the packet is transmitted (hereinafter, referred to as the current packet period). If the measured pilot C/I of the same packet exists, the AT accumulates the pilot C/I of the current packet to the existing pilot C/I in step S420. In step S430, if the same packet was received previously, the AT accumulates the traffic symbols of the same packets in steps S430. In the case of non-hybrid ARQ, the traffic symbols are not accumulated in step S430.

The AT compares the pilot C/I measurement or the accumulated pilot C/I with a predetermined first threshold in step S440. The first threshold is calculated by accumulating a C/I corresponding to the data rate of the current packet as many times as the number of packet occurrences. If the pilot C/I is greater than the first threshold, the AT decodes the accumulated traffic symbols and performs a CRC check on the decoded traffic symbols in step S450.

If no errors are found in the CRC check in step S460, the AT feeds back

the ACK signal to the AN so that the AN discontinues retransmission of the current packet in step S470. The AT transmits the current packet to an upper layer and discards the decoded data and the pilot C/I in step S480. If errors are found in the CRC check in step S460, the AT transmits a signal requesting retransmission of the current packet to the AN in step S462.

On the other hand, if the pilot C/I is equal to or less than the first threshold, the AT compares the pilot C/I with a predetermined second threshold in step S442. The second threshold is a value at which packet errors are sure to be generated even if the current packet is transmitted as many times as allowed for the packet. The second threshold varies with the number of packet occurrences. In the ARQ system, the second threshold is calculated by dividing a required C/I corresponding to the current data rate by a predetermined margin, and multiplying the number of occurrence of the current packet, as in Eq (1).

If the pilot C/I is less than the second threshold, the AT transmits the NACK signal to the AN in step S446. Upon receipt of the NACK signal, the AN initiates transmitting the packet from the beginning slot, or gives up retransmission of the packet and allocates the resources assigned for the packet to another user. If the pilot C/I is greater than or equal to the second threshold, the AT transmits the signal requesting retransmission of the packet to the AN in step S462.

In the second embodiment of the present invention as described above, if the received pilot C/I is greater than the first threshold and CRC errors are found, and if the received pilot C/I is equal to or less than the first threshold and greater than a second threshold, the AT transmits the retransmission request signal to the AN.

Similarly to the first embodiment of the present invention, modifications can be made to the second embodiment. If the accuracy of received C/I measurement is maintained within a predetermined range, the ACK signal can be transmitted directly without the CRC check. The AT compares the received C/I of a forward pilot signal with the first threshold in step S440 and if the received C/I is greater than the first threshold, it transmits the ACK signal directly to the AN in step S470.

If the received C/I is equal to or less than the first threshold in step S440,

it jumps to step S462 and requests packet retransmission to the AN.

The AT can compare the received C/I with the second threshold in step 442 before comparing it with the first threshold and if the received C/I is less than the second threshold, the AT can transmit the NACK signal directly to the AN in step S446.

The present invention has the following advantages: (1) unnecessary decoding and CRC check can be omitted by performing decoding and a CRC check according to a received C/I measurement in both a link adaptation system and an ARQ system. Therefore, channel throughput is increased, the power required for decoding is reduced, and the decrease of feedback time reduces the required capacity of a memory in a transmitter; and (2) unnecessary packet retransmission is prevented by estimating reception link conditions and transmitting the ACK or NACK signal according to the received C/I measurement.

While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

WHAT IS CLAIMED IS:

1. A method of controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots, each slot having a plurality of data bits, and the AT receives the data packet from the AN, the method comprising the steps of:

comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold;

checking for errors in the data packet in a received time slot if the received power is greater than the first threshold; and

transmitting a signal requesting termination of retransmission of the data packet to the AN if no errors are found in the data packet after said checking.

2. The method of claim 1, further comprising the steps of:

determining whether it is a low data rate using a length of a preamble of the received data packet; and

proceeding further with the comparison step if the determined data rate is the low data rate, wherein the low data rate repeatedly transmits the same packet two times or more.

3. The method of claim 1, further comprising the steps of:

determining a data rate corresponding to the received power if errors are found in the data packet in the error check; and

requesting retransmission of the data packet by transmitting the determined data rate to the AN.

4. The method of claim 1, further comprising the steps of:

determining a data rate corresponding to the received power if the received power is equal to or less than the first threshold; and

requesting retransmission of the data packet by transmitting the determined data rate to the AN.

5. The method of claim 1, further comprising the steps of:

comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold; and

transmitting the signal requesting termination of retransmission of the data packet to the AN if the received power is less than the second threshold.

6. The method of claim 5, further comprising the steps of:

determining the data rate corresponding to the received power if the received power is equal to or greater than the second threshold; and

requesting retransmission of the data packet by transmitting the determined data rate to the AN.

7. The method of any of claims 1,4 and 5, the first threshold is calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of the data packet transmissions.

8. The method as claimed in either of claims 5 and 6, the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet

9. A method of controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN [], the method comprising the steps of:

comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold; and

transmitting a signal requesting termination of retransmission of the data packet to the AN if the received power is greater than the first threshold.

10. The method of claim 9, further comprising the steps of:

determining whether it is a low data rate using a length of a preamble of the received data packet; and

proceeding further with the comparison stepif the determined data rate is the low data rate, wherein the low data rate repeatedly transmits the same packet two times or more.

11. The method of claim 9, further comprising the steps of:

determining a data rate corresponding to the received power if the received power is equal to or less than the first threshold; and

requesting retransmission of the data packet by transmitting the determined data rate to the AN.

12. The method of claim 11, further comprising the steps of:

comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold; and

transmitting the signal requesting termination of retransmission of the data packet to the AN if the received power is less than the second threshold.

13. The method of claim 12, further comprising the steps of:

determining the data rate corresponding to the received power if the received power is equal to or greater than the second threshold; and

requesting retransmission of the data packet by transmitting the determined data rate to the AN.

14. The method of any of claims 9 to 13, wherein the first threshold can be calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions

15. The method as claimed in either of claims 12 and 13, wherein the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet

16. A method of controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the method comprising the steps of:

comparing a received C/I of a forward pilot signal received from the AN with a predetermined threshold; and

transmitting a signal requesting termination of retransmission of the data packet to the AN if the received power is less than the threshold.

17. The method of claim 16, further comprising the steps of:

determining whether it is a low data rate using a length of a preamble of the received data packet; and

Proceeding further with the comparison step if the determined data rate is the low data rate, wherein the low data rate repeatedly transmits the same data

packet two times or more.

18. The method of claim 16, the threshold is calculated by multiplying a received C/I corresponding to a current data rate by the maximum number of data packet transmissions, subtracting a predetermined margin from the product, and multiplying the difference by a ratio of the number of already transmitted slots to the total number of slots transmittable for the data packet.

19. A method of controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the method comprising the steps of:

comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold;

determining a data rate corresponding to the received power if the received power is less than or equal to the first threshold; and

requesting retransmission of the data packet to the AN by transmitting the determined data rate to the AN.

20. The method of claim 19, further comprising the steps of:

determining whether it is a low data rate using a length of a preamble of the received data packet; and

proceeding further with the comparison step if the determined data rate is the low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

21. The method of claim 19, further comprising the steps of:

comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold;

determining the data rate corresponding to the received power if the received power is equal to or greater than the second threshold; and

requesting retransmission of the data packet by transmitting the determined data rate to the AN.

22. The method of any of claims 19 to 21, the first threshold is

calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions

23. The method of claim 21, the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet

24. A method of controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the method comprising the steps of:

comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold; and

requesting retransmission of the data packet by transmitting a determined data rate to the AN if the received power is equal to or less than the first threshold.

25. The method of claim 24, further comprising the steps of:

determining whether it is a low data rate using a length of a preamble of the received data packet; and

proceeding further with the comparison step if the determined data rate is the low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

26. The method of claim 24, further comprising the steps of:

comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold; and

requesting retransmission of the data packet to the AN if the received power is equal to or greater than the second threshold.

27. The method of any of claims 24 to 26, the first threshold is calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions

28. The method of claim 26, the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet

29. An apparatus for controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the apparatus comprising:

a device for comparing a C/I of a forward pilot signal received from the AN with a predetermined first threshold;

a device for decoding a data packet in a received time slot and checking for errors in the decoded data packet if the received power is greater than the first threshold; and

a device for transmitting a signal requesting termination of retransmission of the data packet to the AN if no errors are found in the data packet.

30. The apparatus of claim 29, the comparator detects the length of the data preamble of the received time slot, determines whether that is the low data rate and performs the comparison if the determined data rate is a low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

31. The apparatus of claim 29, further comprising:

a device for determining a data rate corresponding to the received power if errors are found in the decoded data packet; and

a device for requesting retransmission of the data packet by transmitting the determined data rate to the AN.

32. The apparatus of claim 31, further comprising:

a device for determining a data rate corresponding to the received power if the received power is equal to or less than the first threshold; and

a device for requesting retransmission of the data packet by transmitting the determined data rate to the AN.

33. The apparatus of claim 31, further comprising:

a device for comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold; and

a device for transmitting the signal requesting termination of retransmission of the data packet to the AN if the received power is less than the

second threshold.

34. The apparatus of claim 33, further comprising:

a device for determining the data rate corresponding to the received power if the received power is equal to or greater than the second threshold; and

a device for requesting retransmission of the data packet by transmitting the determined data rate to the AN.

35. The apparatus of any of claims 29 to 34, the first threshold is calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions

36. The apparatus as claimed in either of claims 33 and 34, the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet

37. An apparatus for controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the apparatus comprising:

a device for comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold; and

a device for transmitting a signal requesting termination of retransmission of the data packet to the AN if the received power is greater than the first threshold.

38. The apparatus of claim 37, the comparator detects the length of the data preamble of the received time slot, determines whether that is the low data rate and performs the comparison if the determined data rate is a low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

39. The apparatus of claim 37, further comprising:

a device for determining a data rate corresponding to the received power if the received power is equal to or less than the first threshold; and

a device for requesting retransmission of the data packet by transmitting

the determined data rate to the AN.

40. The apparatus of claim 37, further comprising:

a device for comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold; and

a device for transmitting the signal requesting termination of retransmission of the data packet to the AN if the received power is less than the second threshold.

41. The apparatus of claim 40, further comprising:

a device for determining a data rate corresponding to the received power if the received power is equal to or greater than the second threshold; and

a device for requesting retransmission of the data packet by transmitting the determined data rate to the AN.

42. The apparatus of any of claims 37 to 41, wherein the first threshold is . calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions.

43. The apparatus as claimed in either of claims 40 and 41, wherein the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet.

44. An apparatus for controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the method comprising:

a device for comparing a received C/I of a forward pilot signal received from the AN with a predetermined threshold; and

a device for transmitting a signal requesting termination of retransmission of the data packet to the AN if the received power is less than the threshold.

45. The apparatus of claim 44, the comparator detects the length of

the data preamble of the received time slot, determines whether that is the low data rate and performs the comparison if the determined data rate is a low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

46. The apparatus as claimed in either of claims 44 and 45, the threshold is calculated by multiplying a received C/I corresponding to a current data rate by the maximum number of data packet transmissions, subtracting a predetermined margin from the product, and multiplying the difference by a ratio of the number of already transmitted slots to the total number of slots transmittable for the data packet.

47. An apparatus for controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the apparatus comprising:

a device for comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold;

a device for determining a data rate corresponding to the received power if the received power is less than or equal to the first threshold; and

a device for requesting retransmission of the data packet to the AN by transmitting the determined data rate to the AN.

48. The apparatus of claim 47, the comparator detects the length of the data preamble of the received time slot, determines whether that is the low data rate and performs the comparison if the determined data rate is a low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

49. The apparatus of claim 47, further comprising:

a device for comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold;

a device for determining the data rate corresponding to the received power if the received power is equal to or greater than the second threshold; and

a device for requesting retransmission of the data packet by transmitting the determined data rate to the AN.

50. The apparatus of any of claims 47 to 49, the first threshold is calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions

51. The apparatus of claim 49, the second threshold is calculated by dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet.

52. An apparatus for controlling transmission of a data packet from an access network (AN) in an access terminal (AT) of a mobile telecommunication system where the AN transmits the data packet in successive time slots each having a plurality of data bits and the AT receives the data packet from the AN, the apparatus comprising:

a device for comparing a received C/I of a forward pilot signal received from the AN with a predetermined first threshold; and

a device for requesting retransmission of the data packet by transmitting the determined data rate to the AN if the received power is equal to or less than the first threshold.

53. The apparatus of claim 52, the comparator detects the length of the data preamble of the received time slot, determines whether that is the low data rate and performs the comparison if the determined data rate is a low data rate, wherein the low data rate repeatedly transmits the same data packet two times or more.

54. The apparatus of claim 52, further comprising:

a device for comparing the received power with a predetermined second threshold if the received power is equal to or less than the first threshold; and

a device for requesting retransmission of the data packet to the AN if the received power is equal to or greater than the second threshold.

55. The apparatus of any of claims 52 to 54, the first threshold is calculated by accumulating a C/I corresponding to the data rate of the current data packet as many times as the maximum number of data packet transmissions.

56. The apparatus of claim 54, the second threshold is calculated by

dividing the required C/I corresponding to a current data rate by a predetermined margin and multiplying the number of already transmitted slots for the current data packet

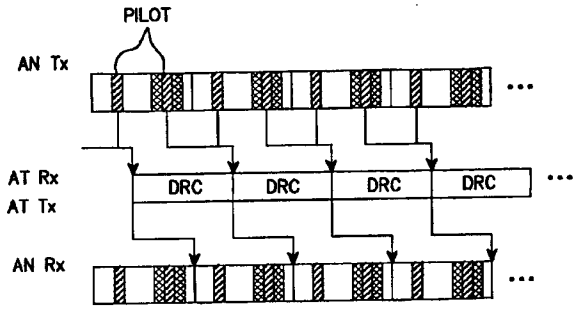


FIG. 1

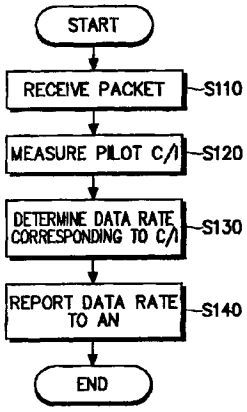

START
RECEIVE PACKET
S110
MEASURE PILOT C/I
S120
DETERMINE DATA RATE CORRESPONDING TO C/I
S130
REPORT DATA RATE TO AN
S140
END

FIG. 2

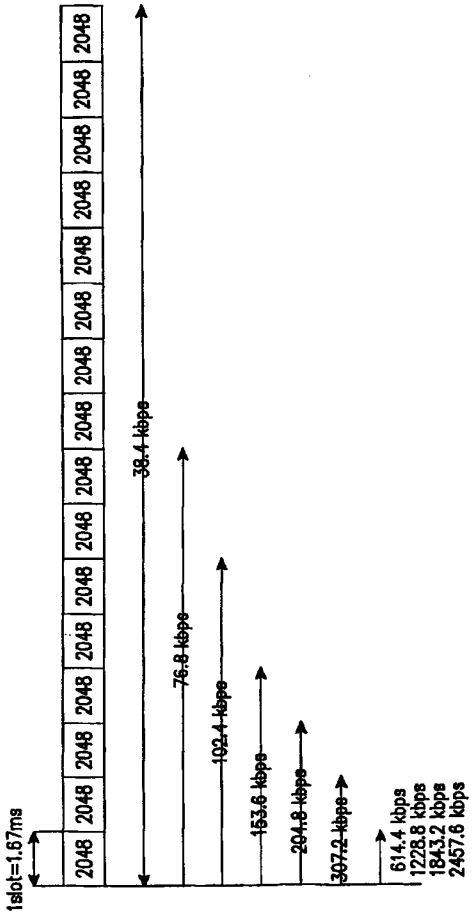

1slot=1.67ms
2048
38.4 kbps
76.8 kbps
102.4 kbps
153.6 kbps
204.8 kbps
307.2 kbps
614.4 kbps
1228.8 kbps
1843.2 kbps
2457.6 kbps

FIG. 3

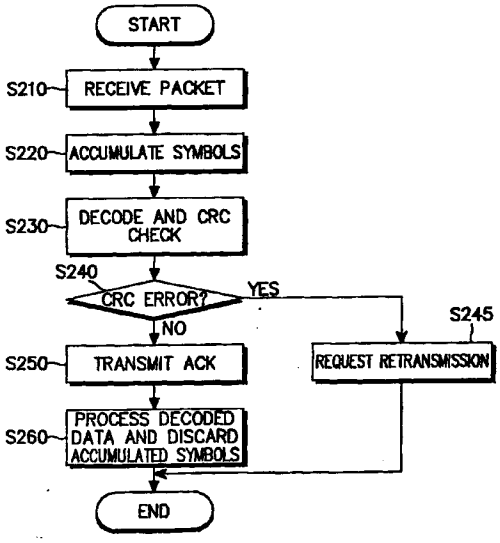

START
S210
RECEIVE PACKET
S220
ACCUMULATE SYMBOLS
S230
DECODE AND CRC CHECK
S240
CRC ERROR?
YES
NO
S245
REQUEST RETRANSMISSION
S250
TRANSMIT ACK
S260
PROCESS DECODED DATA AND DISCARD ACCUMULATED SYMBOLS
END

FIG. 4

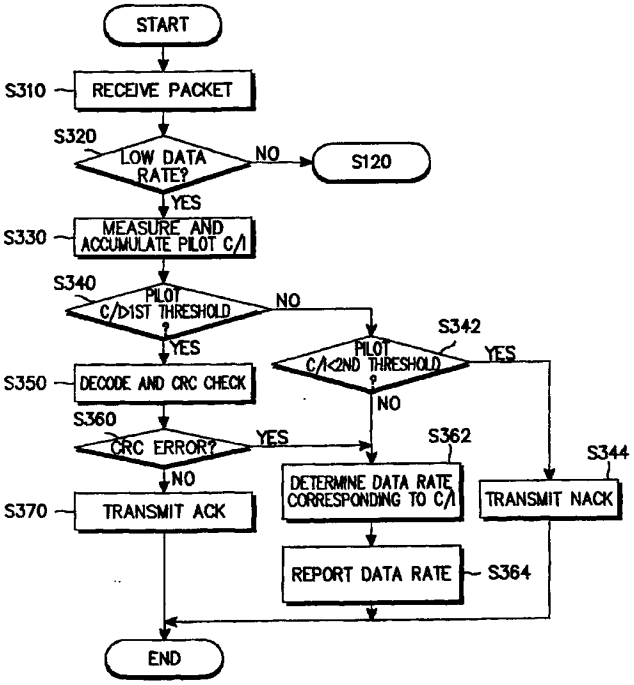

START
S310
RECEIVE PACKET
S320
LOW DATA RATE?
NO
S120
YES
S330
MEASURE AND ACCUMULATE PILOT C/I
S340
PILOT C/I>1ST THRESHOLD ?
NO
S342
PILOT C/I<2ND THRESHOLD ?
YES
YES
S350
DECODE AND CRC CHECK
NO
S360
CRC ERROR?
YES
S362
S344
NO
S370
TRANSMIT ACK
DETERMINE DATA RATE CORRESPONDING TO C/I
TRANSMIT NACK
REPORT DATA RATE
S364
END

FIG. 5

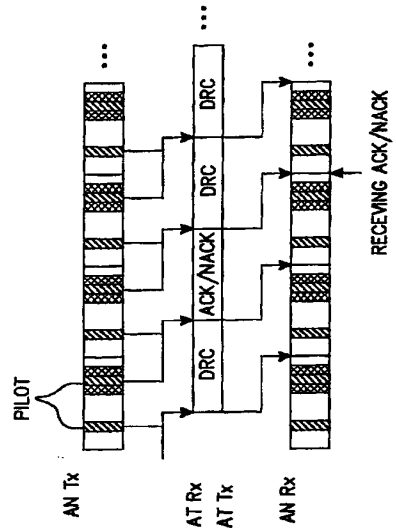

PILOT
DRC
ACK/NACK
DRC
DRC
RECEIVING ACK/NACK
AN Tx
AT Rx
AT Tx
AN Rx

FIG. 6

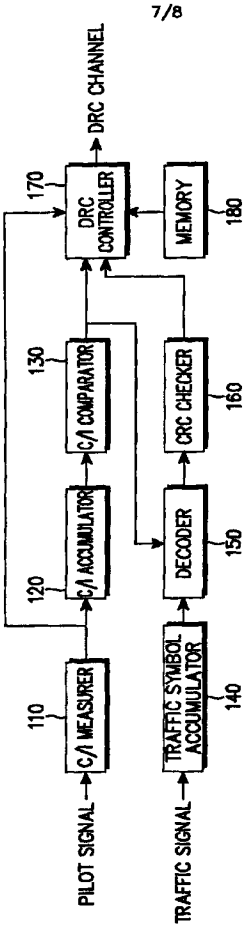

DRC CHANNEL
170
DRC CONTROLLER
MEMORY
180
130
C/I COMPARATOR
CRC CHECKER
160
120
C/I ACCUMULATOR
DECODER
150
110
C/I MEASURER
TRAFFIC SYMBOL ACCUMULATOR
140
PILOT SIGNAL
TRAFFIC SIGNAL

FIG. 7

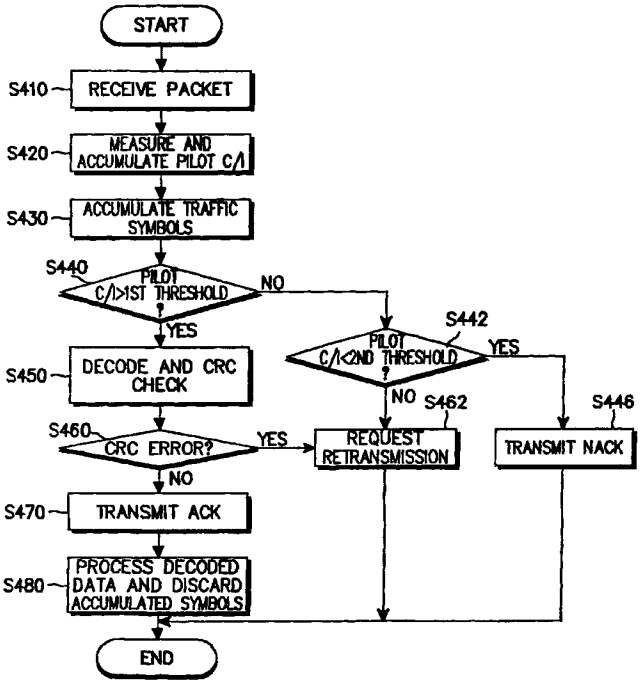

START
S410
RECEIVE PACKET
S420
MEASURE AND ACCUMULATE PILOT C/I
S430
ACCUMULATE TRAFFIC SYMBOLS
S440
PILOT C/I>1ST THRESHOLD ?
NO
YES
S442
PILOT C/I<2ND THRESHOLD ?
YES
NO
S450
DECODE AND CRC CHECK
S460
CRC ERROR?
YES
NO
S462
REQUEST RETRANSMISSION
S446
TRANSMIT NACK
S470
TRANSMIT ACK
S480
PROCESS DECODED DATA AND DISCARD ACCUMULATED SYMBOLS
END

FIG. 8

【国際調査報告】

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR01/01103

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04B 1/69

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7 H04B 1/69, 1/707

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
search terms : variable data rate, packet, retransmission, CRC, ARQ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Y US 5828677 A 27 Oct. 1998 (Lucent Technologies Inc.) see summary of the invention and claim 1, 6, 11	1, 9, 16, 19
Y	Y US 5774496 A 30 June 1998 (Qualcomm Inc.) see summary of the invention and claim 1	1, 29
A	A US 5673266 A 30 Sep. 1997 (Oki Telecom.) see summary of the invention	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
20 NOVEMBER 2001 (20.11.2001)	21 NOVEMBER 2001 (21.11.2001)
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon, Dunsan-dong, Seo-gu, Daejeon Metropolitan City 302-701, Republic of Korea Facsimile No. 82-42-472-7140	Authorized officer JEONG, Jae Woo Telephone No. 82-42-481-5718

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR01/01103

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5828677 A	27 Oct. 1998	EP 797327 A3	4 Oct. 2000
US 5774496 A	30 June 1998	EP 705512 A1	10 Apr. 1996
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Form PCT/ISA/210 (patent family annex) (July 1998)

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Ｆターム(参考) 5K014 AA01 DA03 EA08 FA12
5K067 AA13 BB21 CC08 DD44 DD46 EE02 EE10 GG01 GG11 HH22
HH23 HH28

CLAIMS

[Claim(s)]
[Claim 1]
In an approach for said terminal to control transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
A process [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
The process in which the error of the data packet in the time slot which received will be inspected if said received-power value is larger than said 1st threshold,
The process in which the signal which requires that re-transmission of said data packet should be ended when there is no error in said data packet as a result of said error checking is transmitted to said base station
****** -- the approach characterized by things.
[Claim 2]
The process in which inspect the die length of the preamble of said data packet which received, and it checks whether it is a rate of low-speed data transmission,
The process which will advance in said comparison process if it is a rate of low-speed data transmission as a result of said check
It contains in a pan and is here,
Said rate of low-speed data transmission is an approach according to claim 1 characterized by being the rate of data transmission which carries out repetitive transmission of the same packet twice or more.
[Claim 3]
The process in which the rate of data transmission corresponding to said received-power value is decided when said data packet has an error as a result of said error checking,
The process in which transmit said rate of decision data transmission to said base station, and re-transmission of said data packet is required
The approach according to claim 1 characterized by containing in a pan.
[Claim 4]
The process in which the rate of data transmission corresponding to said received-power value will be decided if said received-power value is smaller than said 1st threshold or the same,
The process in which transmit said rate of decision data transmission to said base station, and re-transmission of said data packet is required
The approach according to claim 1 characterized by containing in a pan.
[Claim 5]
A process [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
The process in which the signal which will require that re-transmission of said data packet should be ended if said received-power value is smaller than said 2nd threshold is transmitted to said base station

The approach according to claim 1 characterized by containing in a pan.
[Claim 6]
The process in which the rate of data transmission corresponding to said received-power value will be decided if said received-power value is larger than said 2nd threshold or the same,
The approach according to claim 5 characterized by including further the process in which transmit said rate of decision data transmission to said base station, and re-transmission of said data packet is required.
[Claim 7]
Said 1st threshold is the approach of any one publication among claim 1 characterized by being the value to which only said count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet, claim 4, and claim 5.
[Claim 8]
Said 2nd threshold is an approach according to claim 5 or 6 which does the division of the received-power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is characterized by being the value which multiplied by the number of the slots already transmitted to the current data packet.
[Claim 9]
In an approach for said terminal to control transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
A process [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
The process in which the signal which will require that re-transmission of said data packet should be ended if said received-power value is larger than said 1st threshold is transmitted to said base station
****** — the approach characterized by things.
[Claim 10]
The process in which inspect the die length of the preamble of said data packet which received, and it checks whether it is a rate of low-speed data transmission,
The process which will advance in said comparison process if it is a rate of low-speed data transmission as a result of said check
It contains in a pan and is here,
Said rate of low-speed data transmission is an approach according to claim 9 characterized by being the rate of data transmission which carries out repetitive transmission of the same packet twice or more.
[Claim 11]
The process in which the rate of data transmission corresponding to said received-power value will be decided if said received-power value is smaller than said 1st threshold or the same,
The process in which transmit said rate of decision data transmission to said base station, and re-transmission of said data packet is required
The approach according to claim 9 characterized by containing in a pan.
[Claim 12]
A process [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
The process in which the signal which will require that re-transmission of said data packet should be ended if said received-power value is smaller than said 2nd threshold is transmitted to said base station
The approach according to claim 11 characterized by containing in a pan.
[Claim 13]
The process in which the rate of data transmission corresponding to said received-power value will be decided if said received-power value is larger than said 2nd threshold or the same,
The process in which transmit said rate of decision data transmission to said base station, and

re-transmission of said data packet is required
The approach according to claim 12 characterized by containing in a pan.
[Claim 14]
Said 1st threshold is the approach of any one publication among claim 9 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 13.
[Claim 15]
Said 2nd threshold is an approach according to claim 12 or 13 which does the division of the received-power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is characterized by being the value which multiplied by the number of the slots already transmitted to said current data packet.
[Claim 16]
In an approach for said terminal to control transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
A process [a predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
The process in which the signal which will require that re-transmission of said data packet should be ended if said received-power value is smaller than said threshold is transmitted to said base station
****** -- the approach characterized by things.
[Claim 17]
The process in which inspect the die length of the preamble of said data packet which received, and it checks whether it is a rate of low-speed data transmission,
Process which will advance in said comparison process if it is a rate of low-speed data transmission as a result of said check It contains further and is here,
Said rate of low-speed data transmission is an approach according to claim 16 characterized by being the rate of data transmission which carries out repetitive transmission of the same packet twice or more.
[Claim 18]
Said threshold is an approach according to claim 16 characterized by being the value which multiplied the received-power value corresponding to the current rate of data transmission only by the count of data packet transmission, and the value which multiplied the difference with predetermined allowances spacing by a number of a slot to the total of the slot of said data packet which can be transmitted of already transmitted ratios.
[Claim 19]
In an approach for said terminal to control transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
A process [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
The process in which the rate of data transmission corresponding to said received-power value will be decided if said received-power value is smaller than said 1st threshold or the same,
The process in which transmit said rate of decision data transmission to said base station, and re-transmission of said data packet is required
****** -- the approach characterized by things.
[Claim 20]
The process in which inspect the die length of the preamble of said data packet which received, and it checks whether it is a rate of low-speed data transmission,
The process which will advance in said comparison process if it is a rate of low-speed data transmission as a result of said check

It contains in a pan and is here,
Said rate of low-speed data transmission is an approach according to claim 19 characterized by being the rate of data transmission which carries out repetitive transmission of the same packet twice or more.
[Claim 21]
A process [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
The process in which the rate of data transmission corresponding to said received-power value will be decided if said received-power value is larger than said 2nd threshold or the same,
The process in which transmit said rate of decision data transmission to said base station, and re-transmission of said data packet is required
****** -- the approach according to claim 19 characterized by things.
[Claim 22]
Said 1st threshold is the approach of any one publication among claim 19 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 21.
[Claim 23]
Said 2nd threshold is an approach according to claim 21 which does the division of the received-power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is characterized by being the value which multiplied by the number of the slots already transmitted to said current data packet.
[Claim 24]
In an approach for said terminal to control transmission of the data packet by said base station by migration communication system containing the terminal which receives said data packet from the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and said base station,
A process [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
The process in which re-transmission of said data packet will be required of said base station if said received-power value is smaller than said 1st threshold or the same
****** -- the approach characterized by things.
[Claim 25]
The process in which inspect the die length of the preamble of said data packet which received, and it checks whether it is a rate of low-speed data transmission,
The process which will advance in said comparison process if it is a rate of low-speed data transmission as a result of said check
It contains in a pan and is here,
Said rate of low-speed data transmission is an approach according to claim 24 characterized by being the rate of data transmission which carries out repetitive transmission of the same packet twice or more.
[Claim 26]
A process [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
The process in which re-transmission of said data packet will be required of said base station if said received-power value is larger than said 2nd threshold or the same
The approach according to claim 24 characterized by containing in a pan.
[Claim 27]
Said 1st threshold is the approach of any one publication among claim 24 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 26.
[Claim 28]
Said 2nd threshold is an approach according to claim 26 which does the division of the received-

power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is characterized by being the value which multiplied by the number of the slots already transmitted to said current data packet.
[Claim 29]
In the equipment for controlling transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
Equipment [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
Equipment which will decrypt the data packet in the time slot which received, and will inspect an error if said received-power value is larger than said 1st threshold,
Equipment which transmits the signal which requires that re-transmission of said data packet should be ended when there is no error in said data packet as a result of said error checking to said base station Equipment characterized by containing.
[Claim 30]
Said comparison equipment is equipment according to claim 29 characterized by being the rate of data transmission which carries out repetitive transmission of the packet with said same rate of low-speed data transmission twice or more here although said comparison process will be performed if it is a rate of low-speed data transmission after inspecting the die length of the data preamble in said time slot which received and checking whether it is a rate of low-speed data transmission.
[Claim 31]
Equipment which determines the rate of data transmission corresponding to said received-power value when said decryption data packet has an error as a result of said error checking,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
Equipment according to claim 29 characterized by containing in a pan.
[Claim 32]
Equipment which will determine the rate of data transmission corresponding to said received-power value if said received-power value is smaller than said 1st threshold or the same,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
Equipment according to claim 31 characterized by containing in a pan.
[Claim 33]
Equipment [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
Equipment which transmits the signal which will require that re-transmission of said data packet should be ended if said received-power value is smaller than said 2nd threshold to said base station
Equipment according to claim 31 characterized by containing in a pan.
[Claim 34]
Equipment which will determine the rate of data transmission corresponding to said received-power value if said received-power value is larger than said 2nd threshold or the same,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
Equipment according to claim 33 characterized by containing in a pan.
[Claim 35]
Said 1st threshold is equipment of any one publication among claim 29 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 34.
[Claim 36]
Said 2nd threshold is equipment according to claim 33 or 34 which does the division of the

received-power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is characterized by being the value which multiplied by the number of the slots already transmitted to said current data packet.
[Claim 37]
In the equipment for controlling transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
Equipment [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
Equipment which transmits the signal which will require that re-transmission of said data packet should be ended if said received-power value is larger than said 1st threshold to said base station
****** -- the equipment characterized by things.
[Claim 38]
Said comparison equipment is equipment according to claim 37 characterized by being the rate of data transmission which carries out repetitive transmission of the packet with said same rate of low-speed data transmission twice or more here although said comparison process will be performed if it is a rate of low-speed data transmission after inspecting the die length of the data preamble in said time slot which received and checking whether it is a rate of low-speed data transmission.
[Claim 39]
Equipment which will determine the rate of data transmission corresponding to said received-power value if said received-power value is smaller than said 1st threshold or the same,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
Equipment according to claim 37 characterized by containing in a pan.
[Claim 40]
Equipment [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
Equipment which transmits the signal which will require that re-transmission of said data packet should be ended if said received-power value is smaller than said 2nd threshold to said base station
Equipment according to claim 37 characterized by containing in a pan.
[Claim 41]
Equipment which will determine the rate of data transmission corresponding to said received-power value if said received-power value is larger than said 2nd threshold or the same,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
Equipment according to claim 40 characterized by containing in a pan.
[Claim 42]
Said 1st threshold is equipment of any one publication among claim 37 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 41.
[Claim 43]
Said 2nd threshold is equipment according to claim 40 or 41 which does the division of the received-power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is characterized by being the value which multiplied by the number of the slots already transmitted to said current data packet.
[Claim 44]
In the equipment for controlling transmission of the data packet by said base station by migration communication system containing the terminal which receives said data packet from the base station which transmits the data packet which is going to transmit two or more data

bits through the continuation time slot which it has, respectively, and said base station,
Equipment [a predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
Equipment which transmits the signal which will require that re-transmission of said data packet should be ended if said received-power value is smaller than said threshold to said base station
****** -- the equipment characterized by things.
[Claim 45]
Said comparison equipment is equipment according to claim 44 characterized by being the rate of data transmission which carries out repetitive transmission of the packet with said same rate of low-speed data transmission twice or more here although said comparison process will be performed if it is a rate of low-speed data transmission after inspecting the die length of the data preamble in said time slot which received and checking whether it is a rate of low-speed data transmission.
[Claim 46]
Said threshold is equipment according to claim 44 or 45 characterized by being the value which multiplied the difference of the value which multiplied the received-power value corresponding to the current rate of data transmission only by the count of data packet transmission, and predetermined allowances spacing by a number of a slot to the total of the slot which can transmit said data packet of already transmitted ratios.
[Claim 47]
In the equipment for controlling transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
Equipment [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
Equipment which will determine the rate of data transmission corresponding to said received-power value if said received-power value is smaller than said 1st threshold or the same,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
****** -- the equipment characterized by things.
[Claim 48]
Said comparison equipment is equipment according to claim 47 characterized by being the rate of data transmission which carries out repetitive transmission of the packet with said same rate of low-speed data transmission twice or more here although said comparison process will be performed if it is a rate of low-speed data transmission after inspecting the die length of the data preamble in said time slot which received and checking whether it is a rate of low-speed data transmission.
[Claim 49]
Equipment [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
Equipment which will determine the rate of data transmission corresponding to said received-power value if said received-power value is larger than said 2nd threshold or the same,
Equipment which transmits said rate of decision data transmission to said base station, and requires re-transmission of said data packet
Equipment according to claim 47 characterized by containing in a pan.
[Claim 50]
Said 1st threshold is equipment of any one publication among claim 47 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 49.
[Claim 51]
Said 2nd threshold is equipment according to claim 49 which does the division of the received-power value corresponding to the current rate of data transmission at intervals of predetermined

allowances, and is characterized by being the value which multiplied by the count already transmitted to said current data packet.
[Claim 52]
In the equipment for controlling transmission of the data packet by said base station by migration communication system containing the base station which transmits the data packet which is going to transmit two or more data bits through the continuation time slot which it has, respectively, and the terminal which receives said data packet from said base station,
Equipment [the 1st predetermined threshold / value / of the forward direction pilot signal received from said base station / received-power],
Whether said received-power value is smaller than said 1st threshold and equipment which will transmit said determined rate of data transmission to a base station, and will require re-transmission of said data packet if the same
****** -- the equipment characterized by things.
[Claim 53]
Said comparison equipment is equipment according to claim 52 characterized by being the rate of data transmission which carries out repetitive transmission of the packet with said same rate of low-speed data transmission twice or more here although said comparison process will be performed if it is a rate of low-speed data transmission after inspecting the die length of the data preamble in said time slot which received and checking whether it is a rate of low-speed data transmission.
[Claim 54]
Equipment [the 2nd predetermined threshold / value / said / received-power] if said received-power value is smaller than said 1st threshold or the same,
Equipment which will require re-transmission of said data packet of said base station if said received-power value is larger than said 2nd threshold or the same
Equipment according to claim 52 characterized by containing in a pan.
[Claim 55]
Said 1st threshold is equipment of any one publication among claim 52 characterized by being the value to which only the count of data packet transmission accumulated the received-power value corresponding to the rate of data transmission of said current data packet thru/or claim 54.
[Claim 56]
Said 2nd threshold is an approach according to claim 54 characterized by being the value which multiplied by the number of the slots which did the division of the received-power value corresponding to the current rate of data transmission at intervals of predetermined allowances, and were already transmitted to said current data packet.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the packet transmission approach and equipment in migration communication system, and relates to an approach and equipment for a terminal (Access Terminal:AT) to control transmission of the data packet by the base station (Access Network:AN) by the condition of a forward channel by the link adaptation method and the ARQ (Automatic Repeat reQuest) method especially.
[0002]
[Description of the Prior Art]
Usually, migration communication system consists of a terminal and a base station. The magnitude of attenuation of a propagation path changes with distance and shadings in the radio channel used with such migration communication system, and since the interference between systems and fading are serious, change of the input-signal pair interference ratio (it is called C/I for short below Carrier to Interference ratio:) by the channel condition is large. A link adaptation method is a technique for adjusting the rate of data transmission and raising the rate (Throughput) of processing of a channel according to channel conditions, such as Reception C/I. Although the rate of data transmission is determined by the rate of coding, and the modulation technique by such link adaptation method Namely, the rate of data transmission is raised using the sign of the rate of coding high when the system which uses a link adaptation method has large receiving C/I, and the modulation technique of a high level. Reception C/I lowers the rate of data transmission using the sign of the low rate of coding, and the modulation technique of a low, when small, it carries out repetitive transmission of the packet alternatively, and raises the reliability of a channel.
[0003]
For example 3GPP(s)2 () [3rd Generation] The physical hierarchy of HDR by the link adaptation method of the forward direction link of HDR (High Data Rate) specification proposed by Partnership Project 2 QPSK (Quadrature Phase Shift Keying), Three sorts of modulation techniques, such as 8PSK (8-ary Phase Shift Keying) and 16QAM (16-ary Quadrature Amplitude Modulation), 1/4, 3/8, and three kinds of rates of coding of 1/2, Furthermore, it can be transmitted by 13 kinds of transmission systems by packet number of occurrence.
[0004]
Drawing 1 shows the HDR forward direction and a hard flow link. If drawing 1 is referred to, a HDR packet will consist of 2048 chips per slot, and 96 chips will be assigned to the pilot channel which exists in a half slot. Since such a pilot channel is transmitted with the same power as a traffic channel, C/I measured to the pilot channel is the same as that of C/I of a traffic channel. Said pilot C/I serves as criteria which choose the rate of coding, and a modulation technique.
[0005]
Drawing 2 is the flow chart which showed packet transmission demand actuation of the HDR system by the conventional technique. If it is the packet which the terminal received after checking whether a terminal is the packet which analyzed the preamble (Preamble) of the packet

whenever it received the packet through each slot at step S110, and the terminal received, if drawing 2 is referred to, it will check whether it is the transmission speed which inspected the die length of a preamble and the terminal required. Then, a terminal measures the receiving C/I value over the pilot signal of said packet at step S120, and determines the rate of data transmission corresponding to said receiving C/I value at step S130. At step S140, feedback transmission of the information on said determined rate of data transmission is carried out in a base station. At this time, the information on said rate of data transmission is called DRC (Data Rate Control), and said DRC is transmitted through the DRC channel of a hard flow link for every slot section, as shown in drawing 1.

[0006]

When said determined rate of data transmission is low, a base station transmits one packet repetitively, in order to secure the reliability of a channel. Drawing 3 shows the die length of the packet by the rate of data transmission of a HDR forward direction link. If drawing 3 is referred to, at the rate of data transmission of 38.4kbps, repetitive transmission of the one packet will be carried out for one packet no less than 8 times by 76.8kbps 16 times. However, in the high-speed-data baud transmission rate from 614.4kbps to 2457.6kbps, one packet is transmitted only once.

[0007]

However, since the slot section which one packet occupies will become long although the reliability of a channel improves if repetitive transmission of the one packet is carried out as mentioned above, the error of channel prediction is large, by change of a channel, the rate of coding and a modulation technique are not corresponded promptly, but one packet occupies a resource for a long time, and waste of a wireless resource occurs. Furthermore, in order that a HDR forward direction link may use the time-sharing (Time Division Multiplexing:TDM) method between users, when a user occupies many time slots by the low baud transmission rate, the overall rate of processing has the trouble of getting worse.

[0008]

On the other hand, by the ARQ (Automatic Repeat reQuest) method, only when CRC (Cyclic Redundancy Check) to the packet which the terminal received is performed and there is an error, packet re-transmission is required of a base station. Therefore, the rate of data transmission becomes low substantially, and the reliability of a channel improves. Furthermore, by the state of the art hybrid ARQ method, the reliability of a packet is further raised by combining and decrypting the packet of the same sequence which lowered the rate of coding at the time of packet re-transmission using the error correction sign, or was re-transmitted.

[0009]

Drawing 4 is the flow chart which showed packet re-transmission demand actuation of the hybrid ARQ (HARQ) system by the conventional technique. If drawing 4 is referred to, a terminal will receive a packet at step S210, will combine said packet which received with the packet of the same sequence which received before at step S220, and will accumulate a packet symbol. It checks whether said terminal has a CRC error at step S240 by decrypting said packet symbol at step S230, and performing CRC. Consequently, if there is no CRC error, said terminal will transmit an ACK (Acknowledgment) signal to a base station at step S250, and will transmit decryption data to an upper level. At step S260, said decryption data are processed with an upper level, and said accumulation symbol is discarded. However, when there is a CRC error, re-transmission of a packet with the same terminal is required at step S245.

[0010]

CRC is performed after decrypting the packet which received by the ARQ method for it to mention above. In this case, if the channel condition is very poor, an error will be continuously detected in a CRC inspection process, this will continue re-transmission, and it will come to require. Therefore, many power is exhausted unnecessary for a repetitive decryption, and the trouble that a feedback time delay also becomes long generates only the time amount concerning a decryption. That is, a terminal needs sufficient mass storage to store many packets.

[0011]

As an approach for raising the rate of processing, there are a link adaptation method and an ARQ method by changing the transmission approach and the count of transmission according to the condition of a channel. However, there is demerit in which the rate reduction problem of processing according [a link adaptation method] to packet iteration transmission and an ARQ method cause power waste and the increment problem of a time delay, and mass storage is needed.
[0012]
[Problem(s) to be Solved by the Invention]
Therefore, the purpose of this invention is to offer the approach and equipment which make a channel adaptation rate quick by the link adaptation method and ARQ method which are used for migration communication system, and raise the rate of processing.
Other purposes of this invention are to offer the approach and equipment which inspect the error of a packet, after determining whether decrypt by the link adaptation method and the ARQ method.
[0013]
Other purposes of this invention are by the link adaptation method and the ARQ method again to offer the approach and equipment which decide whether to re-transmit a packet by the measurement result of a received-power value.
The purpose of further others of this invention is to offer the approach and equipment which decide by the link adaptation method and the ARQ method whether to decrypt a packet by the measurement result of a received-power value.
[0014]
[Means for Solving the Problem]
The purpose of said this invention is attained by the method which adopts migration communication system according to the condition of a channel. In order to control transmission of the data packet from a base station by the link adaptation method and the ARQ method, it inspects whether a terminal has an error in the data packet in the time slot which received the received-power value of the forward direction pilot signal received from the base station when said received-power value was larger than said 1st threshold as compared with the 1st predetermined threshold. Consequently, after a decryption, when there is no error in said data packet, the signal which requires that re-transmission of said data packet should be ended is transmitted to said base station.
[0015]
[Embodiment of the Invention]
Hereafter, the suitable operation gestalt of this invention is explained to a detail with reference to an accompanying drawing. In the following explanation, in order to make only the summary of this invention clear, the concrete explanation about a related well-known function or a configuration is omitted.
[0016]
Hereafter, the vocabulary used by this invention is defined.
ACK: The signal which requires that re-transmission of a packet should be stopped when there is no error in the packet which received
The signal which will require that re-transmission of a packet should be stopped if it is clear that an error occurs continuously even if it re-transmits the packet which NACK(ed) : received
A current packet: The packet which has a series of sequence which is going to carry out current reception
The same packet: The packet which has the same sequence
[0017]
Drawing 5 is the flow chart which showed packet transmission control actuation of the HDR system by the operation gestalt of this invention. It checks whether it is the packet which analyzed the preamble whenever the terminal received the packet through each time slot at step S310, when referring to drawing 5, and the terminal received. If it is checked that it is the packet which the terminal received, a terminal inspects the die length of a preamble at step S320, and checks whether it is a rate of low-speed data transmission. Here, the rate of low-speed data

transmission means the baud transmission rate to which one packet is transmitted more than two times at least. In the case of a high-speed-data baud transmission rate without re-transmission of a packet, a terminal measures the pilot C/I value of the packet which received like the Prior art shown in drawing 2 (step S120), and the rate of data transmission corresponding to said received C/I value is decided (step S130).

[0018]

However, in the case of the rate of low-speed data transmission (at the time of repetitive transmission of a packet), a terminal measures the received-power value over the pilot channel of the forward direction, or the pilot symbol of the forward direction in the time amount section of the packet which carried out current reception at step S330. If the pilot C/I value of said current packet is already measured (i.e., if the current packet is already received), a terminal will calculate pilot C / I value accumulated to said same packet.

[0019]

In step S340, a terminal compares with the 1st predetermined threshold said measured pilot C/I value or accumulated pilot C/I value. Said 1st threshold is a lower limit which secures a packet error rate below in a predetermined value after a decryption. Said 1st threshold is obtained when only the count of packet transmission accumulates the C/I value corresponding to the rate of data transmission of a current packet. That is, a terminal searches the C/I value corresponding to the current rate of data transmission with the C/I table which stores the demand C/I value corresponding to various rates of data transmission, and determines the 1st threshold using said C/I value. The example of demand C / I value over the rate of data transmission, and the 1st threshold was shown in the following table 1.

[0020]

[Table 1]

データ伝送率	要求C／I値	ﾊﾟｹｯﾄ反復回数	第1しきい値
38.4 kbps	-12.0 Db	16	0 dB
76.8 kpbs	-9.0 dB	8	0 dB
102.4 kbps	-7.8 dB	6	0 dB
153.6 kbps	-6.0 dB	4	0 dB
204.8 kbps	-4.8 dB	3	0 dB
307.2 kbps	-3.0 dB	2	0 dB
614.4 kbps	0.0 dB	1	0 dB
921.6 kbps	2.0 dB	1	2 dB
1228.8 kbps	4.0 dB	1	4 dB
1843.2 kbps	7.0 dB	1	7 dB
2457.6 kbps	10.0 dB	1	10 dB

[0021]

When said pilot C/I value is larger than said 1st threshold, a terminal decrypts a current packet at step S350, and an error checking is conducted. Here, although the error checking of a packet is conducted by various kinds of methods and dealt in it, a CRC error-checking method is

adopted in this invention.
When errorless [at step S360] as a result of said CRC inspection, a terminal transmits an ACK signal to a base station at step S370, and a current packet is transmitted to an upper level. As mentioned above, it is shown that an ACK signal does not have an error in the packet which received. The base station which received the ACK signal stops re-transmission of a current packet, and starts transmission of the following packet. On the other hand, when there is an error at step S360 as a result of said CRC inspection, a terminal determines the rate of data transmission corresponding to said pilot C/I value at step S362, and DRC (Data Rate Control) which is said determined rate information of data transmission is transmitted to a base station at step S364. The base station which received said DRC information re-transmits a packet current at the rate of data transmission which a terminal requires.
[0022]
Said pilot C/I value is smaller than said 1st threshold at step S340, or when the same, a terminal compares said pilot C/I value with the 2nd predetermined threshold at step S342. It comes out surely that a packet error exists and said 2nd threshold is a certain pilot C/I value or a accumulation pilot C/I value, though repetitive transmission of the current packet is carried out only for the number of whole slots.
[0023]
When said pilot C/I value is smaller than said 2nd threshold, a terminal transmits a NACK signal for a decryption to a stop and a base station at step S344, and re-transmission of a current packet is stopped. As mentioned above, it is shown that a NACK signal does not have the normal packet which received. In this case, a current packet is accepted as an error with an upper level. The base station which received the NACK signal is re-transmitted from the slot which stops re-transmission of a current packet or begins a current packet. Said pilot C/I value is larger than said 2nd threshold, or when the same, a terminal determines the rate of data transmission corresponding to said pilot C/I value at step S362, and said DRC information is transmitted to a base station at step S364. The base station which received said DRC information re-transmits a packet current at the rate of data transmission.
Here, said 2nd threshold is obtained by the following formula.
[0024]
(Formula 1)
2nd threshold =
(Total / allowances spacing of the slot of a demand C/Ix current packet)
x (total of a slot to the several/current packet of the slot transmitted to the current packet)
= The number of the slots transmitted to the demand C/I/ allowances spacing x current packet
or
(Formula 2)
The 2nd threshold [dB] =
Demand C/I[dB]-allowances spacing [dB]
+ 10xlog10 (the number of the slots transmitted to the current packet)
[0025]
That is, the 2nd threshold is obtained by multiplying by the number of the slots which did the division of the C/I value corresponding to the current rate of data transmission at intervals of predetermined allowances, and were already transmitted to said current packet. Said 2nd threshold changes with the number of the transmitted slots. Said allowances spacing is decided with the reliability over the 2nd threshold. That is, when making reliability over NACK high, allowances spacing is made to increase, and allowances spacing is also made to reduce when making reliability over NACK low.
[0026]
Hereafter, when five slots are transmitted by rate of data transmission 76.8kbps, the example which determines the 2nd threshold is explained. A demand C/I value is set to -9.0dB like [in Table 1], and allowances spacing is set to 3.0dB. The number of the already transmitted slots is 10*log(5) =7.0dB. Said 2nd threshold is -9.0dB-3.0dB+7.0dB=-5.0.
It is set to dB. The example of the 2nd threshold to the number of the slots transmitted by the

baud transmission rate of 76.8kbps(es) was shown in Table 2.
[0027]
[Table 2]

伝送されたスロットの数	第２しきい値
1	-12.0 dB
2	-9.0 dB
3	-7.2 dB
4	-6.0 dB
5	-5.0 dB
6	-4.2 dB
7	-3.6 dB
8	-3.0 dB

[0028]
As mentioned above, a terminal transmits any one of DRC, ACK, and NACK(s) through a DRC channel by the comparison result of receiving pilot C / I value, and the inspection result of a CRC error.
The example of the information transmitted through a DRC channel according to the operation gestalt of this invention was shown in Table 3.
[0029]
[Table 3]

ＤＲＣシンボル	意味
0000	38.4 kbps
0001	76.8 kbps
0010	102.4 kbps
0011	153.6 kbps (short)
0100	153.6 kbps (long)
0101	204.8 kbps
0110	307.2 kbps (short)
0111	307.2 kbps (long)
1000	614.4 kbps
1001	921.6 kbps
1010	1228.8 kbps
1011	1843.2 kbps
1100	2457.6 kbps
1101	ACK
1110	not used
1111	NACK

[0030]
Although 0000 of a 4-bit DRC symbol thru/or 1100 show each rate of data transmission if Table 3 is referred to, 1101 shows ACK and 1111 shows NACK. In Table 3, short shows a packet with long long for a short packet.
Drawing 6 is drawing having shown the slot transceiver relation between the forward direction of the HDR system by the operation gestalt of this invention, and a hard flow link. In drawing 6, if a base station carries out repetitive transmission of the packet through the slot of a forward direction link (AN Tx), whenever a terminal receives each slot, it will return any one of DRC, ACK, and NACK(s) through the DRC channel (AT Tx) of hard flow.
[0031]
Drawing 7 shows the transmitter structure of the HDR terminal by the operation gestalt of this invention. If drawing 7 is referred to, the C/I measuring instrument 110 of a terminal will measure a C/I value to the pilot channel or pilot symbol which received from the base station. The C/I accumulator 120 will accumulate the pilot C/I value of said packet, if it checks whether the same packet is already received and the same packet exists. The C/I comparator 130 transmits the comparison result for said accumulated pilot C/I value to the DRC controller 170 [the 1st predetermined threshold and the 2nd threshold / respectively]. The DRC controller 170 determines the rate of data transmission corresponding to said measured pilot C/I value, and

generates a DRC symbol.
[0032]
The traffic symbol accumulator 140 accumulates the traffic symbol of said same packet, and the decryption machine 150 decrypts said accumulated traffic symbol, only when said accumulated pilot C/I value is larger than the 1st threshold. The CRC tester 160 conducts CRC inspection of said decrypted traffic symbol, and transmits the result to the DRC controller 170.
[0033]
The DRC controller 170 chooses any one of ACK and NACK which were stored in memory 180 based on said C/I comparison result and the CRC inspection result, and DRC symbols, and transmits it through the DRC channel of a hard flow link. The information transmitted to said memory 180 through the DRC channel shown in Table 1 is stored.
[0034]
The operation gestalt of this invention mentioned above can deform. For example, if the measurement accuracy of a received-power value (namely, receiving C/I value) is maintained within fixed limits, an ACK signal can be transmitted without CRC inspection direct. That is, if said received-power value of a terminal is larger than said 1st threshold compared with the 1st threshold, it will run the received-power value measured to the forward direction pilot signal at step S340 to step S370, and it transmits a direct ACK signal to a base station.
[0035]
In other examples, at step S340, if said receiving C / I value are smaller than the 1st threshold or the same, it will advance to step S362 and step S364, and it can require re-transmission of a packet of a base station.
In the example of further others, before a terminal compares a received-power value with the 1st threshold, at step S342, if said received-power value is smaller than said 2nd threshold compared with the 2nd threshold, it will go on to step S344, and a NACK signal can also be directly transmitted to a base station.
[0036]
Drawing 8 is the flow chart which showed packet re-transmission demand actuation of the hybrid ARQ system by other operation gestalten of this invention. If drawing 8 is referred to and a packet will be received from a base station at step S410 to a terminal, a terminal will measure the C/I value of the pilot channel applicable to the time amount section (henceforth the present packet section) when said packet is transmitted. If the pilot C/I value measured to said same packet already exists, said terminal will accumulate the pilot C/I value of a current packet at step S420 to said pilot C/I value which already exists. Furthermore, if said same packet is already received at step S430, said terminal will accumulate the traffic symbol of said same packet. Temporarily, when it is not Hybrid ARQ, a traffic symbol does not accumulate at step S430.
[0037]
A terminal compares with the 1st predetermined threshold said measured pilot C/I value or accumulated pilot C/I value at step S440. Said 1st threshold is a value to which only the number of occurrence of a packet accumulated the C/I value corresponding to the rate of data transmission of a current packet. When said pilot C/I value is larger than said 1st threshold, a terminal decrypts said accumulated traffic symbol at step S450, and conducts CRC inspection.
[0038]
When errorless [at step S460] as a result of said CRC inspection, a terminal carries out feedback transmission of the ACK signal at step S470 in a base station, and re-transmission of a current packet is stopped. A terminal transmits a current packet to an upper level at step S480, and said decryption data and said pilot C/I value are discarded. Furthermore, when there is an error at step S460 as a result of said CRC inspection, a terminal transmits the signal which requires re-transmission of the present packet to a base station at step S462.
[0039]
On the other hand, said pilot C/I value is smaller than said 1st threshold, or when the same, a terminal compares said pilot C/I value with the 2nd predetermined threshold at step S422. It comes out surely that a packet error occurs and said 2nd threshold shows a certain value,

though said current packet is transmitted only for the count of the maximum transmission of said packet. Said 2nd threshold changes with the counts of transmission of a packet. In an ARQ system, as shown in the formula 1, said 2nd threshold does the division of the C/I value corresponding to the current rate of data transmission at intervals of predetermined allowances, and is obtained by multiplying by the count of transmission of a current packet.
[0040]
If said pilot C/I value is smaller than said 2nd threshold, a terminal will transmit a NACK signal to a base station at step S446. The base station which received the NACK signal assigns other users the resource which transmitted from the slot which begins said packet, or abandoned re-transmission of said packet, and was assigned to said packet. On the other hand, if said pilot C/I value is larger than said 2nd threshold or the same, a terminal will transmit the signal which requires re-transmission of said packet to a base station at step S462.
[0041]
As mentioned above, in the 2nd operation gestalt of this invention, a receiving pilot C/I value is larger than the 1st threshold, when there is a CRC error, a receiving pilot C/I value is smaller than the 1st threshold, or the same, and when larger than the 2nd threshold, a terminal transmits the signal which requires re-transmission to a base station.
[0042]
The 2nd operation gestalt of this invention as well as the 1st operation gestalt of this invention can deform. If the measurement accuracy of a receiving C/I value is maintained within fixed limits, an ACK signal can be transmitted without CRC inspection direct. That is, if said receiving C/I value of a terminal is larger than said 1st threshold compared with the 1st threshold, it will run receiving C / I value measured to the forward direction pilot signal at step S440 to step S470, and it transmits a direct ACK signal to a base station.
[0043]
In other examples, at step S440, if said receiving C/I value is smaller than the 1st threshold or the same, it will advance to step S462, and it requires re-transmission of a packet of a base station.
In the example of further others, before a terminal compares receiving C / I value with the 1st threshold, at step S442, if said receiving C/I value is smaller than said 2nd threshold compared with the 2nd threshold, it will go on to step S446, and a NACK signal can be directly transmitted to a base station.
[0044]
[Effect of the Invention]
As mentioned above, this invention has the following advantages. An unnecessary decryption and a CRC inspection process are removed by conducting decryption and CRC inspection in the first place by the measurement result of received power with the migration communication system of a link adaptation method and an ARQ method. Therefore, it can raise the rate of processing of a channel and it not only decreases power consumption required for a decryption, but can decrease the amount required of the transmitter storage by reduction of feedback time amount. Unnecessary packet re-transmission of a base station can be prevented by second predicting the condition of a reception link and transmitting ACK or a NACK signal to a base station by the measurement result of received power.
[0045]
On the other hand, although detailed explanation of this invention explained the concrete operation gestalt, unless it deviates from the claim of this invention, it is clear for it to be possible by those to whom various kinds of deformation has the usual knowledge in an applicable technical field.
[Brief Description of the Drawings]
[Drawing 1] It is drawing having shown the HDR forward direction and a hard flow link.
[Drawing 2] It is the flow chart which showed packet re-transmission demand actuation of the HDR system by the conventional technique.
[Drawing 3] It is drawing having shown transmission of the packet by the HDR forward-data baud transmission rate.

[Drawing 4] It is the flow chart which showed packet re-transmission demand actuation of the hybrid ARQ system by the conventional technique.
[Drawing 5] It is the flow chart which showed packet transmission control actuation of the HDR system by the operation gestalt of this invention.
[Drawing 6] It is drawing having shown the forward direction and the hard flow link of a HDR system by the operation gestalt of this invention.
[Drawing 7] It is drawing having shown the transmitter structure of the HDR system terminal by the operation gestalt of this invention.
[Drawing 8] It is the flow chart which showed packet transmission control actuation of the hybrid ARQ system by other operation gestalten of this invention.
[Description of Notations]
110 -- C/I measuring instrument
120 -- C/I accumulator
130 -- C/I comparator
140 -- Traffic symbol accumulator
150 -- Decryption machine
160 -- CRC tester
170 -- DRC controller
180 -- Memory

[Translation done.]

DESCRIPTION OF DRAWINGS

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